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Adult population structure and behaviour of two seasonal generations of the European Map Butterfly, *Araschnia levana*, species with seasonal polyphenism (Nymphalidae)

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Summary. Adult population structure and behaviour of the spring and summer broods of *Araschnia levana* (Linnaeus, 1758) were studied in order to describe differences in ecological traits between seasonal generations of this polyphenic species. The more numerous summer generation had an unambiguously open population structure, while the population structure of the spring generation tended to be closed. Capture and estimated sex ratios were male-biased in both generations, probably owing to lower site tenacity of females. There were marked diurnal changes in behaviour of both generations. Both sexes fed on flowers during the mornings and late afternoons, while in the early afternoons males perched in aggregations with some features of typical leks. Females were only rarely seen during that time, their appearance provoked males to chase them. Butterflies of the summer generation spent more time nectaring, possibly owing to higher energy requirements associated with higher mobility. Males of the summer generation spent significantly more time flying or chasing as opposed to sitting on their perches, but this might have been a recording artefact. Seasonal alternation of dispersing and sedentary generations, combined with a lek assembly, might be the features which allow the species to respond rapidly to environmental changes.

Zusammenfassung. Struktur und Verhalten adulter Populationen von Frühjahrs- und Sommergenerationen von *Araschnia levana* (Linnaeus, 1758) wurden untersucht, um Unterschiede hinsichtlich ökologischer Parameter zwischen den saisonalen Generationen dieser polyphenetischen Art zu beschreiben. Die individuenreichere Sommergeneration zeigte eine eindeutige offene Populationsstruktur, während die Frühjahrsgeneration zur geschlossenen Populationsstruktur tendiert. Gesammelte und geschätzte Geschlechtsverhältnisse waren von Männchen dominiert, wahrscheinlich aufgrund geringerer Ortstreue der Weibchen. Es gab signifikante Unterschiede im Tagesrhytmus beider Generationen. Beide Generationen erscheinen in den Morgenstunden sowie am späten Nachmittag zum Nektarsaugen an Blüten, während sich die Männchen am frühen

Nachmittag in typischen Lek-artigen Aggregationen niederlassen. Weibchen wurden zu dieser Zeit nur selten beobachtet, ihre Erscheinung provozierte die Männchen sie zu jagen. Die Falter der Sommergeneration verbrachten mehr Zeit beim Nektarsaugen, möglicherweise um größere Energieressourcen anzulegen, die mit einer höheren Mobilität korrelieren. Männchen der Sommergeneration verbrachten signifikant mehr Zeit fliegend oder jagend anstatt sich niederzulassen, aber dies kann auch ein Beobachtungsartefakt sein. Saisonale Änderungen sich ausbreitender und seßhafter Generationen, kombiniert mit Lek-Ansammlungen, mögen die Voraussetzungen für diese Art sein, rasch auf Umweltänderungen zu reagieren.

Résumé. La structure et le comportement des populations d'adultes des générations printanières et estivales de *Araschnia levana* (Linnaeus, 1758) ont été étudiées afin de décrire les différences dans les affinités écologiques entre les générations saisonnières de cette espèce polyphénique. La génération estivale, qui est la plus abondante, a, sans ambiguité, une structure ouverte alors que celle de printemps tend à rester fermée. La capture et la sex ratio des mâles est biaisée dans les deux générations, probablement en raison de la ténacité des femelles à occuper les sites bas. Il y a des changements diurnes marqués dans le comportement de chaque génération. Les deux sexes s'alimentent sur des fleurs le matin et tard dans l'après-midi, alors qu'en fin d'après-midi les mâles s'agrègent et se perchent avec quelques aspects comportementaux typiques. Les femelles sont rarement aperçues durant cette période, leur apparition conduisant les mâles à les chasser. Les papillons de la génération estivale passent plus de temps à s'alimenter, probablement en raison de leurs besoins de resources en énergie plus intenses liés à leur plus forte mobilité. Les mâles de la génération d'été passent significativement plus de temps à voler ou patrouiller plutôt que sur leurs perchoirs, mais ceci pourrait être un artéfact d'observation. L'altération saisonnière de dispersion et de sédentarité des générations, associée à un comportement de rassemblement, pourraient représenter des caractères permettant à l'espèce de répondre rapidement aux changements de l'environnement.

Key words: *Araschnia levana*, adult population, butterfly dispersal, lek, male assemblages, mate-locating behaviour, seasonal polyphenism.

Introduction

Seasonal polyphenism in butterflies is an adaptive trait, which allows species living in areas with changing but seasonally predictable climates, to avoid costs of genetic polymorphism while maintaining benefits of two adaptive strategies (Shapiro, 1976, 1980). The European Map Butterfly *Araschnia levana* (Linnaeus, 1758) (Nymphalidae) is a model example of seasonal polyphenism in butterflies. Adults of the spring generation (f. *levana*) are reddish with a fritillary-like black pattern, whereas the butterflies of the summer generation (f. *prorsa*) have white stripes on a black ground-colour and resemble black admirals (*Limenitis camilla*

(Linnaeus, 1764)) (Shreeve, 1992a). An occasional third (autumn) generation (referred to as f. *porima* or f. *intermedia*) is intermediate between the two. Proximately, the polyphenism is controlled by day length together with temperature and other cues which change regularly with time of year (Müller, 1955, 1956; Shapiro, 1976).

The species ranges throughout the Palaearctic, reaching Japan and the Russian Far East to the east (Korshunov, 1972; Korshunov & Gorbunov, 1995). The western edge of its distribution is situated in France, where the species is expanding westward and has reached the Atlantic coast but recently (Radigue, 1994–1995). In southern Europe, there are isolated populations in Spain (Higgins & Riley, 1980), the southern limits of the continuous European distribution of the species are found in northern Croatia and Romania (Niculescu, 1965) down to northern Greece (Koutroubas, 1991). The butterfly is relatively common in Central Europe. However, it is not as widely distributed as other nettle-feeding Nymphalids. The preferred habitats are wet meadows adjoining rivers and streams, river valleys and moist deciduous forests (Hrubý, 1956; Reinhardt & Richter, 1978, Ebert & Rennwald, 1991); it was reported that the species avoids early successional habitats (Steffan-Dewenter & Tscharntke, 1997).

Larvae of *A. levana* feed on nettles (*Urtica* spp.; in Central Europe only *Urtica dioica*). They live gregariously after emerging from the eggs, which are laid in a unique string-like pattern (Porter, 1992) on undersides of nettle leaves. The overwintering stage is the pupa.

Published studies of seasonal polyphenism in *A. levana* have so far focused on the developmental mechanism of the phenomenon and its relation to temperature change (Süffert, 1924), length of day (Müller, 1955, 1956; Reinhardt, 1969, 1984) or biochemical factors (Koch, 1996). On the other hand, field-oriented studies of the species' population ecology and behaviour are practically missing. The few published papers did not study the seasonal generations comparatively. Instead, they focused on habitat selection or climatic requirements of *A. levana* in comparison with closely related (in both taxonomic and ecological sense) species (Reinhardt & Richter, 1978; Reinhardt, 1984). The European Map Butterfly thus remains a surprisingly enigmatic species despite fairly good know-

ledge of proximate mechanisms of its polyphenism, extensive research conducted on other European nettle-feeding Nymphalids (Bryant *et al.*, 1997, and references therein) and at least two authors' (Brakefield & Shreeve, 1992) discussion of possible rewards of such studies.

We attempted to fill this gap in our knowledge and stated the following aims: (1) to compare adult population size and structure, mobility and other parameters of the two seasonal generations of *A. levana*, (2) to describe the behaviour of adults of *A. levana* in field conditions, to study their distribution, mating activities and changes of behaviour with time of day and (3) to look for differences, if any, between the spring and summer generations.

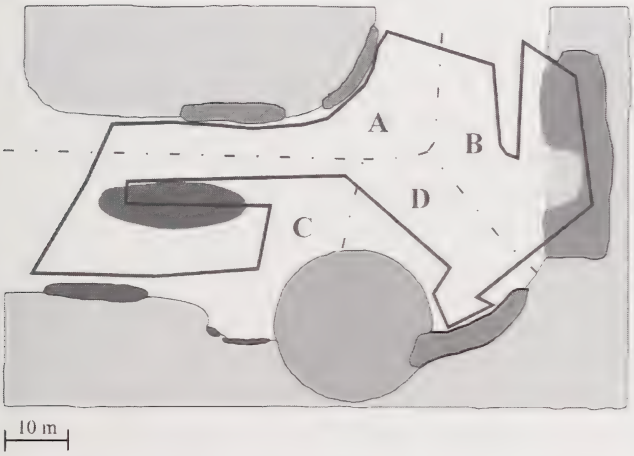


Fig. 1. Map of the study site showing the meadow (white), surrounding woody vegetation (light grey) and nettle patches (dark grey). The black line shows the position of the transect route; letters A, B, C, D are the subsites which were recognised for analysis. The grey circle is the large lime tree overseeing the meadow.

Methods

The lack of field research conducted so far on *A. levana* could possibly be explained by methodological problems inherent to working with common butterflies with open populations (see Shreeve, 1995). Given our previous experiences with *A. levana* and published information on closely related butterflies (tribus

Nymphalini) (Baker, 1972; Warren, 1992; Shreeve, 1995), we expected an open population structure. However, many of the methods used in this work are typically applied for butterflies which live in spatially restricted (closed) colonies (*sensu* Warren, 1992). When applying these methods, we understood this limitation but believed that our approach might at least indicate the most important trends, if not bring complete answers to the questions under study.

The fieldwork was carried out in the spring and summer of 1997, with additional observations in 1998. The study site (Fig. 1) was a moist meadow with dominant grass *Alopecurus pratensis,* 1.5 km south of Hluboká nad Vltavou, South Bohemia (49°02' N, 14°28' E, 375 m). The locality is situated within a varied landscape of meadows, fishponds, hedgerows and moist forests known as the České Budějovice Basin. The meadow was surrounded by habitats apparently unsuitable for *A. levana*: there was a mature oak-spruce forest on two sides, on one side there was a fishpond bank overgrown by reed, one side was delimited by a dense hedgerow along a water channel. Nettles (*Urtica dioica*) formed several distinct patches within the study site. We divided the meadow into four subsites which differred in the character of vegetation and distribution of nettles. Subsite A was a meadow-forest margin oriented to the South with nettles growing under the canopy; subsite B was a large nettle patch along a fishpond bank covered by reed; subsite C was in the centre of the meadow with nettles in sparse bunches interspersed with tall grasses; subsite D was a border between the meadow and a hedgerow with a large lime tree dominating the woody vegetation.

We applied three methods in the field. Population size and structure were estimated by (1) standard mark-release-recapture (MRR) techniques, (2) behaviour and diurnal activity were assessed by regular observations along a fixed transect and (3) by following of individual butterflies with portable tape-recorders.

For the MRR study, the butterflies were netted and marked by waterproof alcohol-based pens. We used the 1–2–4–7 system (Ehrlich & Davidson, 1960) with minute modifications. Wing wear (four categories as in Warren, 1987) was recorded for each captured butterfly.

Progressive estimates of butterfly numbers, obtained during one-day marking (Thomas, 1983), were calculated in order to detect whether the population of *A. levana* was closed or open. The results of such estimates should gradually improve in accuracy in a closed population, but increase meaninglessly if the population is open. The estimates for individual time intervals were obtained according to Craig (1953). The analysis was performed only on fine days, when the weather allowed continuous marking from dawn to dusk (May 17, 18 and 24, 1997 and May 9, 1998 for the spring generation and July 17, 28, 30 and August 5, 1997 for the summer generation).

Population sizes were estimated separately for generations and sexes. Numbers of individuals were calculated by the Jolly-Seber method, which allows for open populations (Jolly, 1965). Computing was done by program JOLLY, model A (Pollock *et al.*, 1990). Residence times were calculated using the formula $-\ln(\varphi)^{-1}$ (Cook, 1967; Tabashnik, 1980), mean residences per generation φ_A's were obtained by the variance weighted averaging method (Tabashnik, 1980). Tabashnik's (1980) joint residence-catchability test and capture vs. estimated sex ratio test were performed in order to detect whether differences in numbers of males and females were caused by different residence or catchability of sexes. The joint residence-catchability test plots the natural logarithm of recapture probability ratio against time and allows a distinction between the effects of unequal residences and unequal recapture probability (between sexes). The capture vs. estimated sex ratio test estimates relative catchability of males and females for a sampling day and gives an average estimate for a set of dates (for details of the tests, see Tabashnik, 1980; Gall, 1984; Murphy *et al.*, 1986).

Behaviour was observed along a fixed transect route (about 400 m), which crossed the entire meadow (Fig. 1). We walked along the transect three times per hour and recorded the behaviour of all observed butterflies and the subsite where they were seen. We discriminated four subsites (see above) and seven types of behaviour: 1 – nectaring, 2 – flight, 3 – perching on herbaceous vegetation, 4 – perching on trees/shrubs, 5 – chasing with other butterflies, 6 – any behaviour unambiguously connected with reproduction (copulation, egg-laying etc.), 7 – resting. By definition, only males could

have been included in the "perching" categories. A butterfly was considered as "perching" when sitting on tops of herbaceous vegetation or at distal ends of tree/shrub branches; males sitting in lower layers of vegetation were listed as "resting". The data were analysed separately for generation, sex and part of day (morning vs. afternoon). Altogether, 70 transects were walked for the spring generation (May 15, 16 and 19, 1997) and 78 for the summer generation (July 17 and August 6 and 10, 1997).

Early in the course of the study, we noticed an aggregation of perching males regularly occurring at subsite B during the afternoon hours (see *Results* section). In both generations, we followed the males with a tape-recorder. We picked-up a sitting male and recorded its behaviour for the longest possible time, i.e., until the observer lost contact with the animal. The longest recorded observations lasted 837 and 641 seconds for males of spring and summer generations, respectively. The recorded observations were subsequently split into 2-minutes intervals for further analysis, and the observations shorter than 120 seconds were discarded. Flight, chasing, resting and basking were distinguished. The tape-recorded behavioural categories differred from those used for the transect analysis, because it was not possible to distinguish between "basking" and "perching" during the transect walks, while during the tape-recording we classified sitting with opened wings as "basking" and sitting with closed wings as "resting". (Also note, that the entire activity observed with tape recorders was perching.) For the spring generation, observations were carried out on May 17 and 23, 16 observations were analyzed and 49 discarded. The summer generation was observed on July 17 and August 3. Sixteen observations were analysed and 24 discarded.

All behavioural data were log-transformed to achieve normality and analysed using the *Statistica v. 5* (StatSoft Inc.) package.

Results

Population size and structure. The first individuals of the spring generation were observed on May 3 in 1997, the last specimen flew on May 28. The summer generation was on the wing from July 7 until August 28 in 1997. The progressive one-day estimates of population size (Fig. 2) indicated that the butterflies of the summer

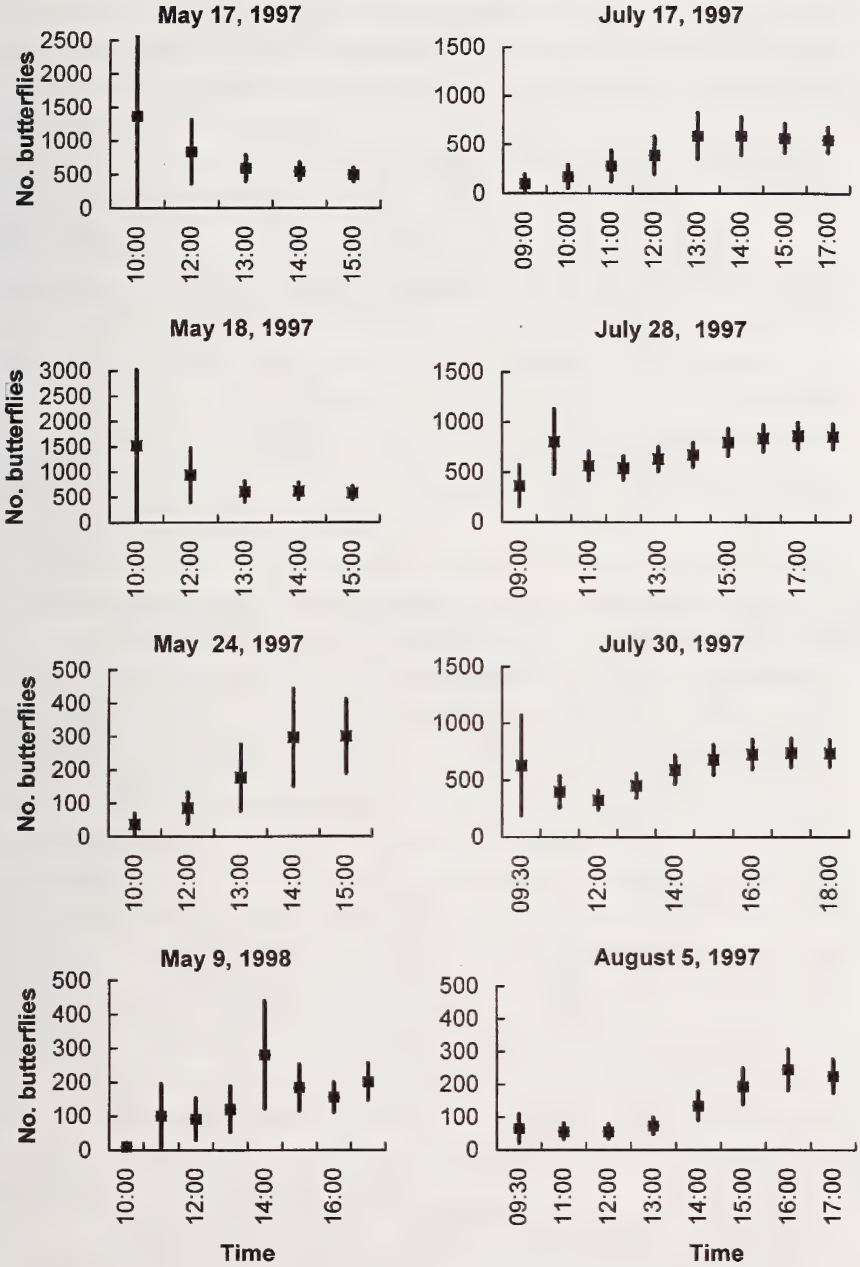


Fig. 2. Progressive one-day estimates of population size of the two seasonal generations of *A. levana*, with their respective standard errors. Left: spring generation, right: summer generation. Note that y-axes are not in scale.

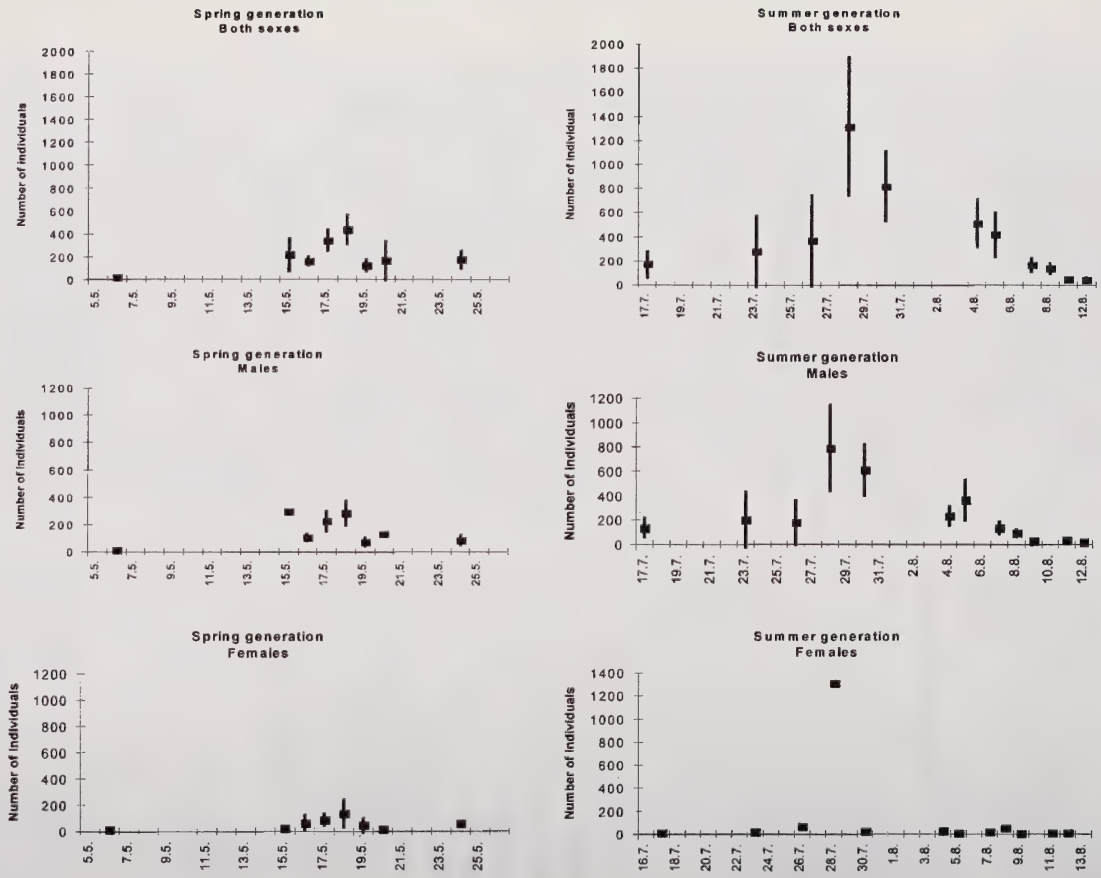


Fig. 3. Estimates of population size of spring and summer generations of *A. levana*, obtained by the Jolly-Seber method. Respective standard error bars are given only for those days for which they were computable from the data.

generation had a typical open population structure. The situation was more ambiguous for the spring generation, for which two repetitions of the experiment indicated a closed and two repetitions an open population structure.

Table 1 summarises daily catches of butterflies for MRR analysis. The Jolly-Seber estimates of daily numbers (Fig. 3) revealed that the adults of the summer generation were more abundant than those of the spring generation. Capture sex ratio males:females was male-biased in both generations (deviation from 1:1 ratio, spring: $\chi^2_{(1)} = 45.2$, $p < 0.001$; summer: $\chi^2_{(1)} = 1.64*10^{-72}$, $p << 0.001$). The estimated sex ratios were also heavily male-biased (spring: $\chi^2_{(1)} = 9.7*10^{-74}$, $p << 0.001$; summer: $\chi^2_{(1)} = 5.3*10^{-78}$, $p << 0.001$). The prevalence of males did not change during their flight periods in both generations. However, the estimates for females, and the sex ratio estimates, were highly unrealistic due to low capture and recapture rates (see below).

There were no significant differences in single-day residences between males and females within the two generations (paired t-test, spring: $t_{(6)} = 1.13$, $p = 0.30$; summer: $t_{(7)} = -1.05$, $p = 0.33$). The residence statistics (Table 1) reveals shorter residence of males of summer generation. The joint residence-catchability tests were not significant for either generation. (Residence time males vs. females, spring: $F_{(1,4)} = 0.003$, $p = 0.96$; summer: $F_{(1,3)} = 0.96$, $p = 0.40$. Relative catchability males vs. females, spring: $t_{(4)} = 1.63$; $p = 0.18$; summer: $t_{(3)} = 2.41$; $p = 0.09$.) Therefore, the tests failed to distinguish whether the biased sex ratios were due to unequal residences or catchabilities. There were no significant differences with regard to residence and catchability between the generations (ANOVA comparison of the regression lines from the joint residence - catchability tests, residence: $F_{(1,7)} = 0.187$, $p = 0.68$; catchability: $F_{(1,8)} = 0.043$, $p = 0.84$). The capture vs. estimated sex ratio test did not reveal any significant difference in catchability among sexes of the spring generation ($\chi^2_{(1)} = 0.25$, $p = 0.62$), while males of the summer generation were significantly more catchable than females ($\chi^2_{(1)} = 106.04$, $p < 0.001$).

Wing wear was steadily increasing in spring males, spring females and summer males. In these cases, the increases were statistically significant (slopes of the regression lines of average wing

wears plotted against time, spring males: $F_{(1,8)} = 16.73$, $p < 0.05$; spring females: $F_{(1,8)} = 13.59$, $p < 0.01$; summer males: $F_{(1,12)} = 132.42$, $p < 0.01$). On the other hand, no significant trend was found for the wing wear progression of summer females ($F_{(1, 12)} = 2.76$, $p = 0.12$).

Table 1. Summary of MRR catches and residence statistics of *Araschnia levana*. φ_is are the estimated residences for individual periods, φ_As are the mean residences per generation obtained by the variance weighted averaging method. Div/O denotes the periods for which the residence was not computable from the data.

	Males			Females		
	captured	recaptured	φ_i	captured	recaptured	φ_i
spring generation						
5 May	4	0		5	0	
6 May	9	1	0.25	10	1	0.20
15 May	62	0	0.93	26	2	0.84
16 May	38	14	0.62	9	1	0.50
17 May	42	10	0.90	21	4	0.91
18 May	73	26	1.13	28	9	1.22
19 May	24	17	0.34	7	2	0.21
20 May	5	0	0.33	2	1	0.37
24 May	42	11	0.92	8	1	Div/O
26 May	21	8		9	4	
mean residence (φ_A)			0.29			0.21
mean residence time (days)			1.8			1.5
Summer generation						
16 July	68	0		12	0	
17 July	74	16	0.47	15	1	0.09
23 July	48	4	0.77	18	0	Div/O
26 July	46	1	0.48	13	0	0.64
28 July	140	7	0.92	35	1	1.93
30 July	123	24	0.84	27	2	Div/O
4 August	51	12	0.76	27	0	Div/O
5 August	48	14	1.12	7	0	Div/O
7 August	42	11	0.48	7	0	0.58
8 August	40	16	0.56	9	1	1.22
9 August	25	16	0.26	9	3	0.11
11 August	23	6	0.61	11	1	0.33
12 August	20	7	0.26	7	2	0.55
13 August	11	3		4	2	
mean residence (φ_A)			0. 43			0.50
mean residence time (days)			0.5			3.3

Behaviour, distribution. In both generations, there were marked differences in behaviour at different times of the day (see Figs 4, 5 for illustrative examples). Both sexes spent the morning hours nectaring on flowers, whereas most of the individuals disappeared from the observers' sight during noon (approximately from 12:00 AM till 1:00 PM) and were spotted only occasionally in the canopy of surrounding trees. Later, a distinct assemblage of males was daily observed on the sparse nettle bunches in the central part of the study site (subsite C). The males perched with closed wings on top of both nettle plants and grass blades (which were often topping the nettles). The average number of males which were seen perching in this site per transect was 5.3 in spring (40 "afternoon" transects, N = 223, SE = 2.14) and 6.4 in summer (44 transects, N = 275, SE = 3.98). Mutual chases among the males were frequent (spring: 86 chases tape-recorded; summer: 46 chases tape-recorded). The males often attacked other flying insects (one dragonfly, two bees, 14 peacocks — *Inachis io* (Linnaeus, 1758) — and 14 pierids). During this time, the females were practically absent from the meadow. If an occasional female showed up near the aggregation of males (four such observations were tape-recorded), her presence provoked repeated bouts of chasing, in which several males participated. The butterflies flew in ascending spirals during such chases, reaching about 10 m height above the meadow. Afterwards, the males either returned to the perching site or disappeared from sight.

Table 2. ANOVA results for behaviour of *A. levana* butterflies along the fixed transect.

Factor, interaction	**d.f.**	**MS Effect**	**F**	**p-level**
Generation	1,112	0,05	0,114	0,74; NS
Sex	1,112	16,10	40,613	<< 0,0001
Behaviour	6,112	18,41	46,446	<< 0,0001
Time of day	1,112	9,78	24,674	<< 0,0001
Generation-sex	1,112	0,18	0,448	0,51; NS
Generation-behaviour	6,112	4,03	10,162	<< 0,0001
Generation-time of day	6,112	7,82	19,725	<< 0,0001
Sex-behaviour	6,112	0,25	0,626	0,43; NS
Sex-time of day	6,112	9,26	23,377	<< 0,0001
Behaviour-time of day	6,112	6,64	16,758	<< 0,0001

In late afternoons, both sexes were again seen nectaring on flowers. On fine sunny days, the last individuals were nectaring until sunset.

Four-way analysis of variance of the behavioural observations from the transect (with the number of individuals as the frequency variable) (Table 2) confirmed the diurnal periodicity in behaviour and distribution of sexes. Sex, type of behaviour and time of day all had a significant effect on the number of individuals observed on the transect. Furthermore, the combined influences of factors generation-behaviour, sex-behaviour, time of day-behaviour and time of day-sex were also significant (Fig. 6). Butterflies of the summer generation spent more time feeding; only males were engaged in perching and chasing; perching and chasing were significantly more frequent during the afternoon hours.

Analysis of variance for distribution of butterflies within the study site (Table 3) revealed that both generation and sex significantly influenced butterfly distribution. Feeding subsites of the two generations differred according to distribution of nectar plants; males of both generations were more frequently encountered at subsite C, where they formed the afternoon perching aggregation (see above).

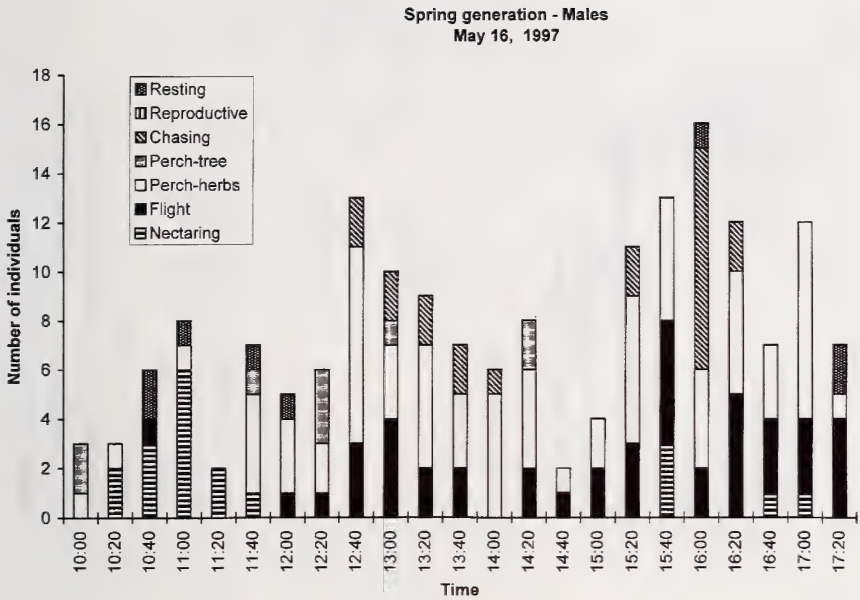
The analysis of tape-recorded behavioural observations revealed that the summer generation males spent less time flying/chasing and more time resting when compared with the spring generation (one-way ANOVA, $F_{(3, 82)} = 8.76$, $p << 0.001$).

Table 3. ANOVA results for behaviour of *A. levana* butterflies along the fixed transect.

Factor, interaction	d.f.	MS Effect	F	p-level
Subsite	3, 56	7,98	7,976	< 0,001
Generation-subsite	3, 56	6,96	6,963	< 0,001
Sex-subsite	3, 56	3,19	3,199	< 0,05
Time of day - subsite	3, 56	1,15	1,148	0,34; NS

Discussion

Adults of the summer generation of *A. levana* were more abundant and less restricted in their movements. Both generations had



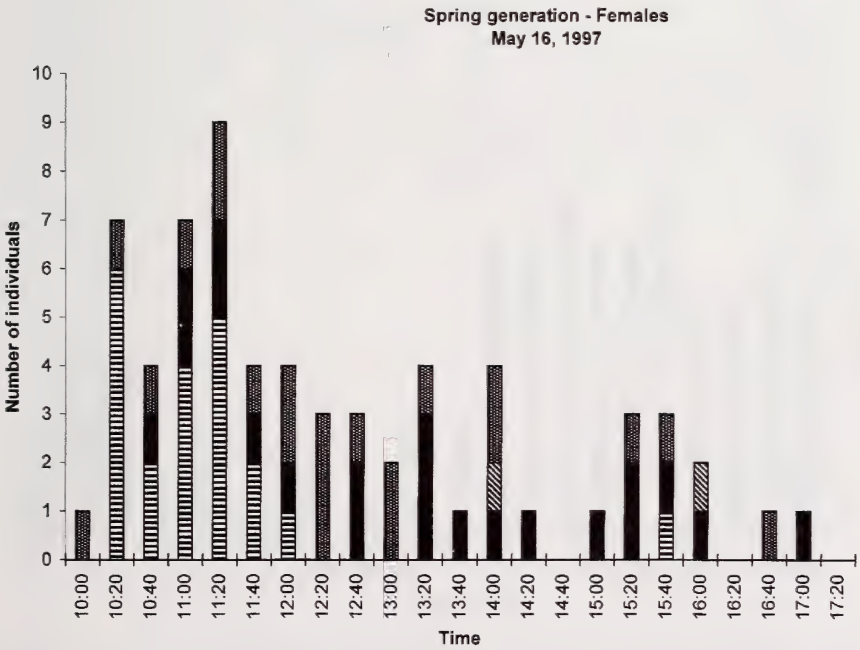


Fig. 4. Diurnal changes in activity of *A. levana*, adults of spring generation.

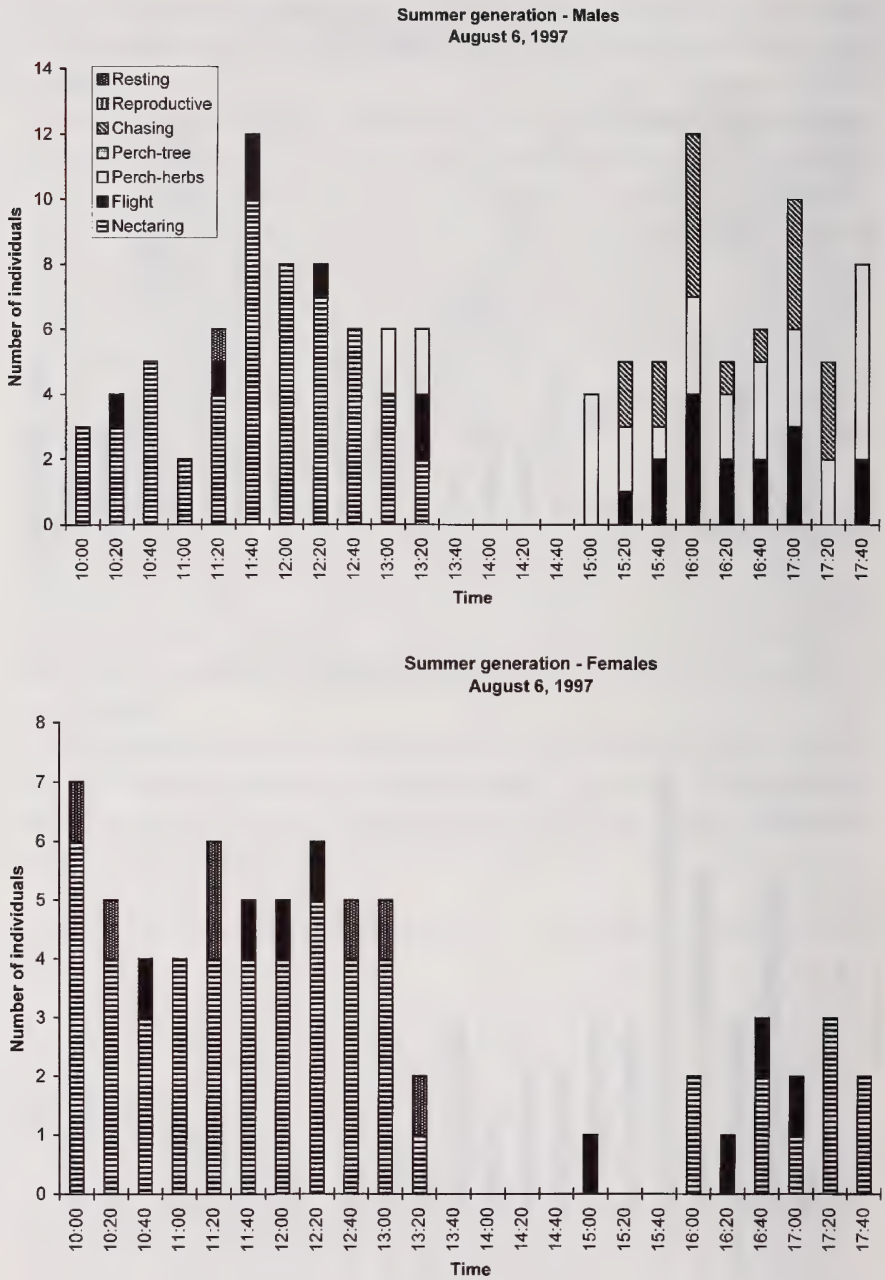


Fig. 5. Diurnal changes in activity of *A. levana*, adults of summer generation.

6a)

6b)

6c)

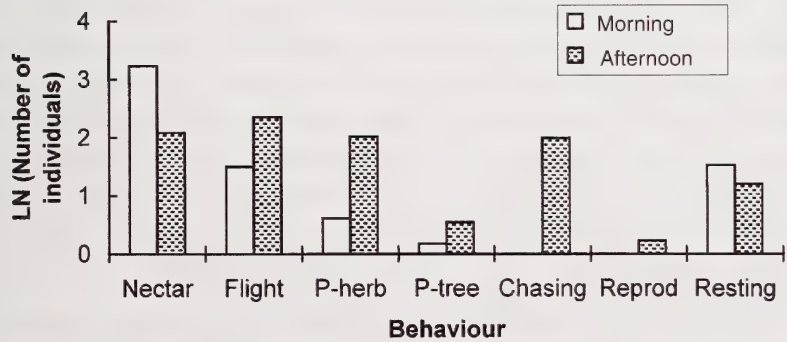


Fig. 6. Behaviour of *A. levana* adults as it was observed along the transect route (log-scale), with respective standard error bars: *a* – behaviour observed in spring vs. summer generations; *b* – behaviour observed for individual sexes; *c* – behaviour observed in morning vs. afternoon hours. Note the log-scale of y-axis.

male-biased capture and estimated sex ratios, their behaviour was characterised by predominance of nectaring in the morning hours and aggregate perching of males in the afternoon hours.

The lower abundance of adults of the spring generation suggests that the overwintering generation of *A. levana* might suffer high mortality during diapause. Host plants growing in spring usually have a high nutrient content (cf. Slansky, 1993) and, as a result, abundant progeny of the spring-flying adults replenishes the population numbers. This might correlate with different mobility of the two generations. Whereas the spring-flying adults might profit from not leaving the site where they successfully completed their development (such a site, by definition, provides all essential resources for them), it may be beneficial for individuals of the summer generation to leave. Higher population density of the summer generation may lead to competition for larval resources, this in turn lowering the emigration threshold (Baker, 1984). Differing mobility among generations has been assumed for several butterfly species and has been considered as one of the traits which allow multivoltine butterflies to become widespread in cultivated landscapes (Pollard & Eversham, 1995).

Three, admittedly circumstantial, lines of evidence suggest a higher mobility of the summer generation. First, the summer generation had a distinctly open population structure, while the situation was rather ambivalent in spring. Second, the females of the summer generation were rarely recaptured, being significantly less catchable than males. This trait caused the inflated estimates of their abundance (see Fig. 3). Third, the females of the summer generation did not show a significant increase of wing wear with time. This again suggests that they might not spend much time on the study site and instead might move rather freely across the landscape. Nevertheless, none of the arguments can be considered as a direct proof of higher mobility of the summer-flying adults, which might be obtained only by direct mark-release-recapture work covering a broader array of habitat patches (Hanski *et al.*, 1994; Sutcliffe *et al.*, 1997; Baguette *et al.*, 1998).

An intriguing problem, that recurrently emerges in butterfly population studies, is the male bias in both capture and estimated sex ratios (Scott, 1974, 1975; Daily *et al.*, 1991; Sutcliffe *et al.*, 1997).

Sexual differences in both distribution and behaviour are reported for many butterfly species (cf. Wiklund, 1977, 1982; Wiklund & Åhrberg, 1978; Baguette *et al.*, 1998). The sex-specific differences in both behaviour and distribution found in this study (Fig. 6, *b*) are the most plausible explanation of the biased sex ratios in *A. levana*. Males of both generations spent most of the days within the reach of observers, whereas the females regularly "disappeared" for several hours around noon. Furthermore, the males assembled at one site in the afternoon hours, which rendered them easily catchable. On the other hand, the joint residence-catchability tests failed to show significant differences between sexes in both residence and catchability. We assume that the failure was caused by the low number of females recaptured, in particular if more days elapsed between the first and subsequent captures. Consequently, the residence-catchability regression lines were constructed from too few points: compare the low number of degrees of freedom in our tests with those in Tabashnik (1980) and Gall (1984). It is notoriously difficult to separate different dispersal rates from different longevities (Tabashnik, 1980; Shreeve, 1992b, 1995); our residence statistics (see Table 1) do not suggest any conclusive solutions. Murphy *et al.* (1986) highlighted the necessity of nearly complete, labour intensive marking of the entire population, to obtain accuracy of such tests. This was admittedly not the case in this study, as the MRR days alternated with days devoted to behavioural observations.

Brakefield & Shreeve (1992) suggested the "fascinating" possibility that different wing colours of seasonal generations of *A. levana* might result into different mate-locating behaviours. They expected fritillary-like patrolling in the spring generation and admiral-like perching in the summer generation (vividly coloured butterflies tend to patrol rather than perch — Shreeve, 1992a). Our observation showed that in *A. levana*, males of both generations perch. Perching is restricted to the afternoon hours; in this respect, the diurnal changes in behaviour of *A. levana* resemble those of other European nettle-feeding Nymphalids (*Inachis io*, *Aglais urticae* (Linnaeus, 1758) and *Vanessa cardui* (Linnaeus, 1758) — Baker, 1972; Scott, 1974). However, early morning perching was reported for some Nymphalids and the time of eclosion of females

was proposed as the explanation for the timing of activity of males (Rutowski *et al.*, 1996).

The perching activity in *A. levana* was characterised by the aggregation of males within one patch of the habitat, while the rest of the study site was virtually empty. Scott (1974) stated that perching should result to "distributing males more evenly throughout mating sites" due to mutual harassment in male to male encounters. In our study, nothing indicated any spacing apart — or territoriality — of males, which was described for other perching species (cf. Baker, 1972; Davies, 1978; Dennis & Williams, 1987; Rutowski *et al.,* 1996). In agreement with Knapton (1985), we suggest that such a situation might be interpreted as lekking, bearing in mind that the term may be used only in a relaxed sense for non-vertebrates (Lederhouse, 1982; Knapton, 1985; Alcock, 1987; Daily *et al.*, 1991; Shreeve, 1992a).

Typical lekking assemblages of males should, according to the original definition (Bradbury, 1977), occur at a place which lacks any larval or adult resources. Furthermore, individual males should monopolise exclusive patches within the lek and the males with the best (typically central) positions should enjoy most of the matings (Knapton, 1985; Wickman, 1985; Wickman & Jansson, 1997). The situation was different in *A. levana,* where the aggregation occurred at a foodplant patch. On the other hand, no other foodplant patch within the study site hosted such an aggregation and males competed for their perches as well as for females (e. g. the mutual pursuits). Also, we gained no evidence of females ovipositing (or hanging around) at the aggregation site, at least during the afternoon hours. Indeed, this would be disadvantageous for them due to continuous harassment by males. Further study should focus on elucidating the questions (1) where the ovipositions do actually occur and (2) whether the males compete for their positions within aggregation sites.

Although both the transect and tape-recorder results pointed to behavioural differences between generations, the evidence is weak and the interpretation of data is not straightforward. The behavioural differences between the generations documented in the analysis of the tape-recorder data may have been caused by the different colours of the seasonal morphs: the disruptive wing pattern

of the summer generation specimens might be responsible for the fast disappearance of flying/chasing males from the observers' sight. This alone would bias the data towards a higher proportion of the "resting" category. Moreover, a climatic (possibly temperature) element might have influenced the behavioural results and this question deserves a further, temperature-controlled study. On the other hand, the transect-gained observation that butterflies of the summer generation spent more time nectaring seems to be robust. This might be explained by higher energy requirements of the more active summer generation of these ecothermic insects.

Pollard & Eversham (1995) speculated that widespread British butterflies, such as nettle-feeding Nymphalids, benefited from changes brought by modern agriculture (e.g. fertilizers) and became more abundant recently than they had been in the past. Recently, *A. levana* has indisputably become a common species in Central Europe. Although our evidence is only circumstantial, it is possible that the habit of alternating sedentary and dispersing generations, when the sedentary generation stays in more favourable habitats and the dispersing generation leaves these in search for new space, combined with a lek-assembly mating system (which ensures that the sexes meet despite their dispersing habits), might allow the species to respond rapidly to changing natural conditions and to fluctuate in range and abundance. Such fluctuations are indeed documented in literature (Hrubý, 1956; van Swaay, 1990; Beneš & Kuras, 1997) and there is evidence of recent range expansion and occasional migrations along the southern, western and northern edge of the range (Koutroubas, 1991; Radigue, 1994–1995; Bradley, 1998).

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A new bagworm species of the genus *Dahlica* (Psychidae) from southeastern Ukraine

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Summary. A new bagworm species, *Dahlica karatyshica* sp. nov., is described from the steppe of Ukraine. It is characterised by its small size, the reduction of some veins, an average genitalic index equal to 1.1 and a habitat preference for xerophytic vegetation, which is not typical for other known species of the genus.

Zusammenfassung. Eine neue Sacktragerart, *Dahlica karatyshica* sp. nov., wird aus der ukrainischen Steppe beschrieben. Charakteristisch für diese Art sind eine geringe Korpergröße, die Reduktion einiger Adern, ein durchschnittlicher Genitalindex von 1.1 sowie die Anpassung an xerophytische Vegetation, welche in dieser Gattung außergewöhnlich ist.

Résumé. Une nouvelle espèce de psychide, *Dahlica karatyshica* sp. nov., est décrite de la steppe d'Ukraine. Elle est caractérisée par une taille réduite, la réduction de certaines veines, un indice génitalique de 1.1 et une adaptation à une végétation xérophytique, qui est atypique dans ce genre.

Key words: Lepidoptera, Psychidae, *Dahlica*, new species, steppe, Ukraine.

During two collecting trips in May 1997 and in April 1998 to the virgin steppe of Kamennye Mogily Nature Reserve (SE Ukraine, Donetsk oblast' [province]), 38 males and 6 females (only two female specimens are included in the type series — see below) of a new bagworm species were found. One more male was captured in May 1998 in the neighbouring Lugansk oblast' (Proval'ska Steppe Nature Reserve). By an aggregate of characteristics (lack of epiphysis, lack of medial cells on both fore- and hindwing, female pupal antennae equal to legs), the new species is conditionally assigned to the genus *Dahlica* Enderlein, 1912 (type species: *Tinea triquetrella* Hübner, [1812]), to which it looks much more closely related than to the representatives of other Dahlicini genera like *Siederia* Meier, 1953, *Brevantennia* Sieder, 1953, *Eosolenobia* Filipjev, 1924 and *Praesolenobia* Sieder, 1954. The new species

rather occupies an intermediate position between *Postsolenobia* Meier, 1958 and *Dahlica* (cf. Meier, 1958); its generic position still requires clarification.

Terminology and principles of diagnosis are accepted herewith according to Sauter (1956), Galliker (1958) and Arnscheid (1985) unless stated otherwise; the taxonomic structure of the genus according to Sauter & Hättenschwiler (1991, 1996).

Fig. 1. *Dahlica karatyshica* sp. nov. holotype ♂.

Dahlica karatyshica sp. nov.

Holotype ♂, "Ukraina, distr.[ictus] Donetsk, res.[ervatum] Kamennye Mogily, 26. IV. 1998, leg. E. Rutjan, ex pupa 28.IV.1998"; designated with label on printed form "Holotypus" (in italics) with handwritten insertion: "*Dahlica karatyshica Rutjan, sp. n.*, ♂, *Ukraina, res. Kamennye Mogily* (recto) and "*Coll. Schmalhausen Inst. Zool., Kiev*" (verso). Paratypes: 35♂, 2♀, "Ukraina, distr. Donetsk, res. Kamennye Mogily, 26.IV.1998, leg. E. Rutjan, ex pupa 26.IV–3.V.1998"; ♂, "Ukraina, distr. Donetsk, res. Kamennye Mogily, 9.V.1997, leg. E. Rutjan"; ♂, "Ukraina, distr. Lugansk, prope Sverdlovsk, pag.[us] Provalje, 10.V.1998". — Holotype and a part of the paratypes are deposited in the Lepidoptera collection, Schmalhausen Institute of Zoology (Kiev), a part of the paratype series is forwarded to Zoological Museum, Taras Shevchenko National University (Kiev) and Zoological Institute, Russian Academy of Sciences (St.-Petersburg).

Male (Fig. 1). Smallest among *Dahlica* species: wingspan 7–9 mm. Head (Fig. 2) covered with grey ruffled hairs. Labial palpi

Fig. 2. *Dahlica karatyshica* sp. nov. paratype ♂: head structures (antennal scales and bristles removed).

approximately $2^1/_2$ shorter than eye diameter. Antenna with 24–26 segments, ca. 0.6 of forewing length. Each antennal segment bearing a belt of light-coloured scales at its top and bristles equal or somewhat longer than the length of the bearing segment. Space between eyes exceeding 0.33 of their diameter. Ocelli lacking. Thorax and tegulae light grey. Wings (Figs 3, 4) narrow: forewing length $3^1/_2$ times, and that of hindwing 4 times exceeding its width. Hindwings $^1/_4$ narrower than forewings. Fringes wide, more than half of wing width; on forewing, along external and anal margins paler than the wing ground-colour, on hindwing and along costal margin of forewings the fringes are grey. They consist of long thin two- and three-dentate scales of various length and ciliae (Fig. 3, *f–i*; Fig. 4, *c–f*). Forewing pattern consisting of grey-brown lace-like reticulation, darker in basal area. Pale spots grey-yellow. Cloaking scales of forewing (Fig. 3, *a*) classified into classes IV–V according to Sauter (1956), whereas according to Solyanikov (1990) they comply with nos. 4–4.5. Underlying two-dentate cuneiform scales (Fig. 3, *b*) of various length. Area between subcostal vein and costal margin covered with short two-dentate cuneiform scales only (Fig. 3, *c*). Area between veins A_{2+3} and anal margin covered with scales with rounded tip (Fig. 3, *d*). Hindwings covered exclusively with cuneiform two-dentate scales (Fig. 4, *a*). Forewing with 10 veins going out to the margin, of which A_1 is less well expressed (n = 4; Fig. 3). Radial accessory cell

developed only in part of the examined specimens. Veins R_2 and R_3, R_4 and R_5, and M_2 and M_3 merged pairwise. External margin of discal cell slight. Hindwing with 9 veins (Fig. 4). Intercalar cells lacking. Vein branching not observed. Veins M_2 and M_3 completely merged. Legs dark. Foretibia (Fig. 5, *a*) without epiphysis. Midtibia (Fig. 5, *b*) with one, and hindtibia (Fig. 5, *c*) with two pairs of spurs. Abdomen dark, covered with sparse light scales. Genital segments densely covered with long light-coloured scales.

Male genitalia (Fig. 6). Length of valve exceeding 3 times its width in middle part, and 5 times exceeding saccus with vinculum. Base of sacculus situated at the middle of inferior margin of valve. Cucullus length 2.5 times its width. Tegumen with uncus 3.2 times longer than vinculum with sacculus. Genitalic index approx. 1.1 (n = 3). Androconial scales two times shorter than total length of sacculus and vinculum.

Male pupa structure as shown in Fig. 7.

Female (Fig. 8). It was impossible to describe the female alive. Of 6 available female specimens only 2 could be kept intact. Body length with protruded ovipositor 3.7 mm. Eyes small, diameter 2.6 times less than the space between them and approximately equal to antenna scape length (Fig. 9). Labial palpi well distinctive. We did not manage to determine the exact number of antennal segments, but their number certainly exceeds 8. Tarsi of all legs with 4 segments (Fig. 10). Foretibia without epiphysis (Fig. 10, *a*). Mid- and hindtibia bearing one pair of spurs (Fig. 10, *b, c*).

Female genitalia (Fig. 11). Ovipositor long and sclerotized. Apophyses thin and long. Free ends of posterior apophyses (when ovipositor protruded) reaching the ostium (Fig. 11, *b*). Postvaginal plate heart-shaped (Fig. 11, *b*). Thorns of intersegmental membrane single and pointed, both long and short (Fig. 11, *c*). Postvaginal plate membraneous area with merged and singular thorns, short and wide (Fig. 11, *d*). Hairs of 7th segment normal.

Female pupa. Length of antennae covers exceeding length of forelegs covers (Fig. 12).

Distribution. Up to the present, *D. karatyshica* sp. nov. is known only from the type locality (SE Ukraine, Donetsk and Lugansk oblast's [provinces]).

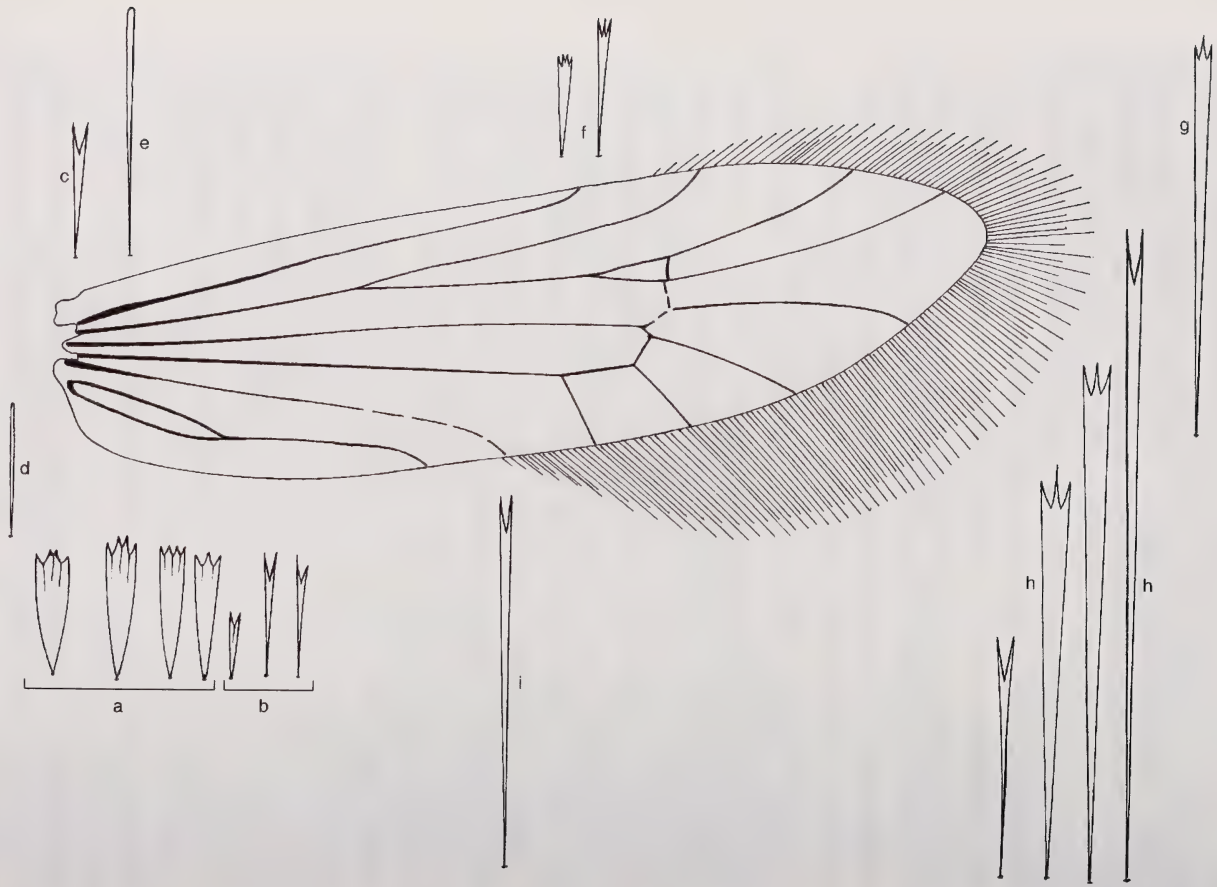


Fig. 3. *Dahlica karatyshica* sp. nov. paratype ♂, forewing venation and upperside scales: *a* – cloaking scales; *b* – underlying scales; *c* – scales between vein Sc and costal margin area; *d* – scales between A_{2+3} and anal margin area; *e* – scales of costal margin; *f* – costal margin fringe scales; *g* – apex fringe scales; *h* – external margin fringe scales; *i* – anal margin fringe scales.

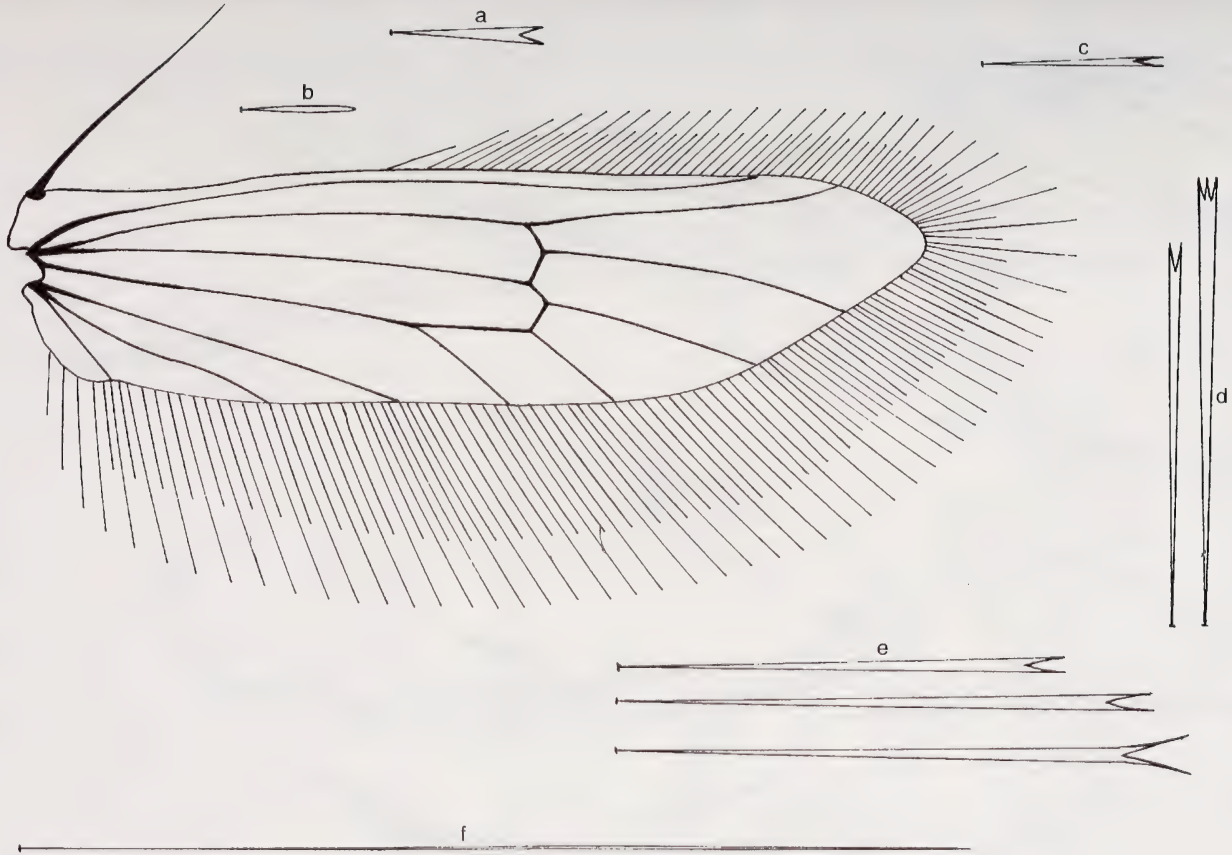


Fig. 4. *Dahlica karatyshica* sp. nov. paratype ♂, hindwing venation and upperside scales: *a* – cloaking scales; *b* – scales of costal margin; *c* – costal margin fringe scales; *d* – external margin fringe scales; *e* – anal angle fringe scales; *f* – anal margin fringe scales.

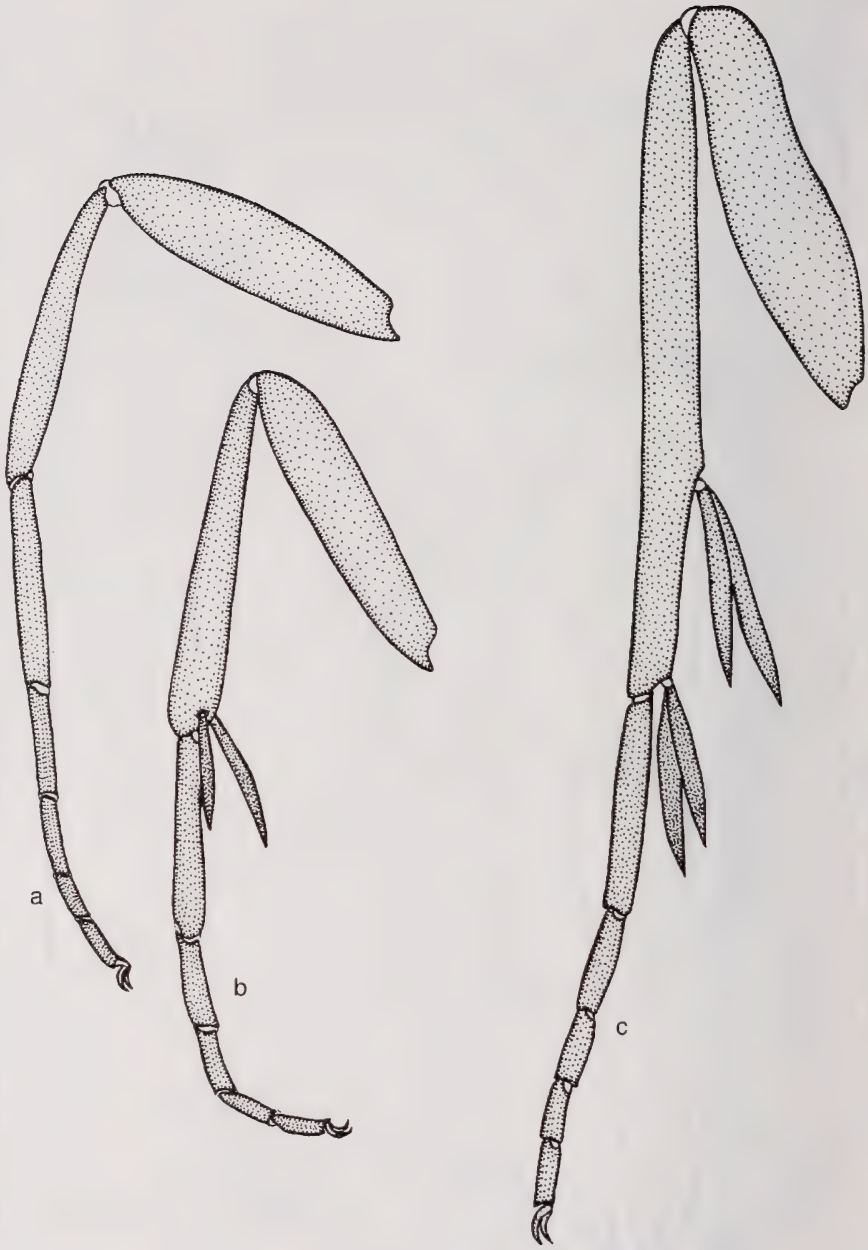


Fig. 5. *Dahlica karatyshica* sp. nov. paratype ♂: *a* – foreleg; *b* – midleg; *c* – hindleg.

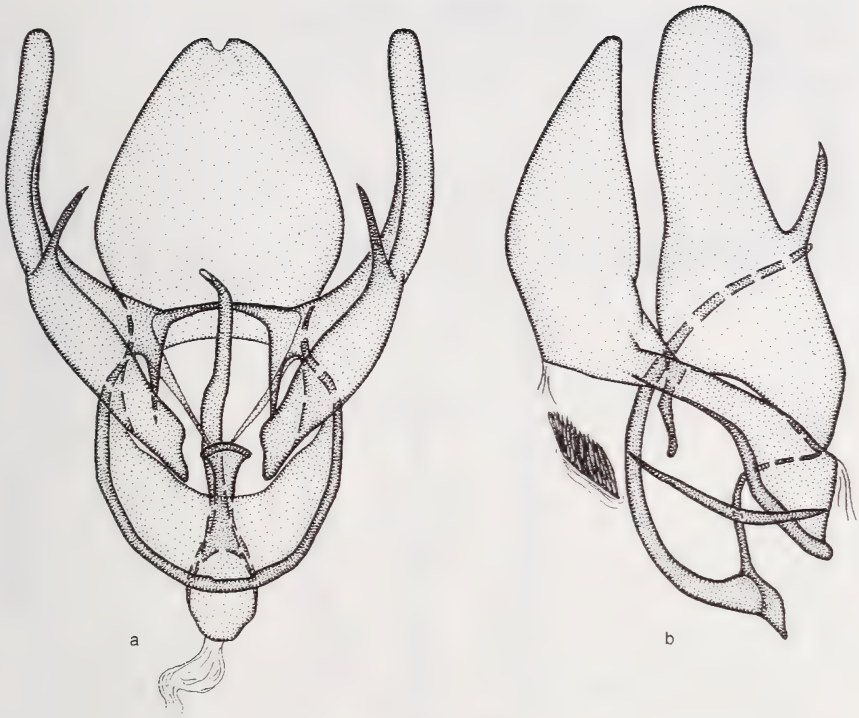


Fig. 6. Male genitalia *Dahlica karatyshica* sp. nov. paratype ♂: *a* – ventral view; *b* – lateral view.

Bionomics. Flight period from late April to the middle of May, with peak in late April–early May, in a single brood. It is known to occur in a *Stipa capillata*+*Festuca sulcata*+*Festuca varia* steppe association of the *solum petrosum* variant, where together with *Reisseronia staudingeri* (Heylaerts, 1879), it inhabits granite outcrops on river banks (see Rutjan, 1998). Cases were collected on slopes with a north-east exposure, attached to the sides of large stones, with the caudal end freely hanging down. The pupal stage lasts no less than 10 days. Under laboratory conditions males emerged during the evening hours (20:00–22:00), but started flying only the next morning (ca. 7:00). Females emerged in the morning (5:30–8:00). Life span of males (as observed in captivity) was 2, and that of females about 3 days and nights. The larvae most prob-

ably feed on lichens. According to field observations, *D. karatyshica* sp. nov. is a stenotopic species, occurring in places with a xerophytic vegetation.

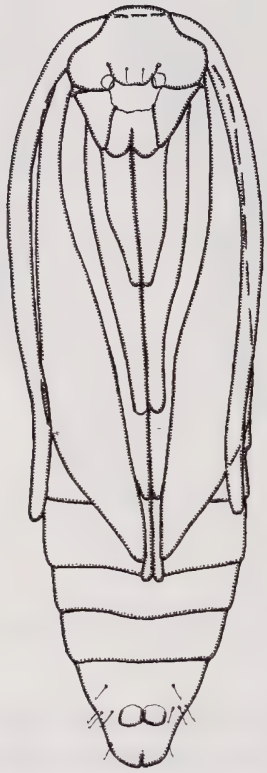


Fig. 7. *Dahlica karatyshica* sp. nov. male pupa exuvium.

Type locality. SE Ukraine, Donetsk oblast' (province), Kamennye Mogily Nature Reserve.

Etymology. The name is derived from Karatysh, a small river at the type locality.

Similar species. By size and genitalic index the new species is close to *Postsolenobia thomanni* (Rebel, 1936), *Dahlica* (?) *pallidella* (Zagulajev, 1997) and *Siederia transsilvanica* Herrmann & Weidlich, 1999, but differs from these by a number of characters.

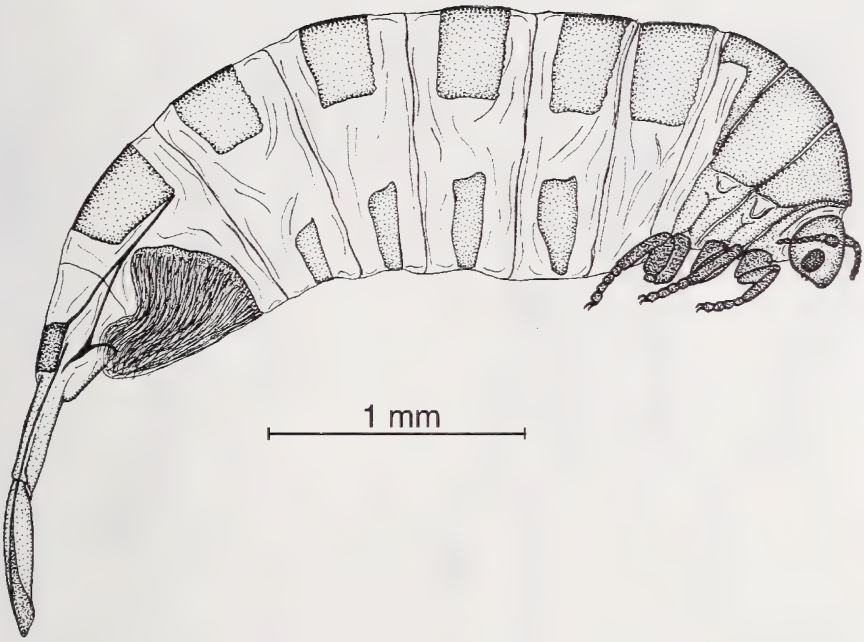


Fig. 8. *Dahlica karatyshica* sp. nov. paratype ♀ (reference bar 1 mm).

Fig. 9. *Dahlica karatyshica* sp. nov. paratype ♀: head structures.

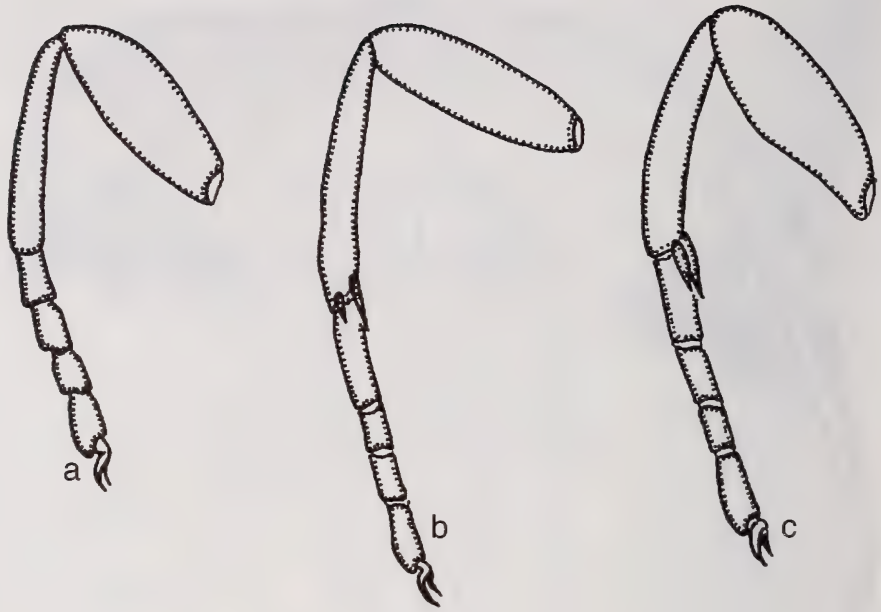


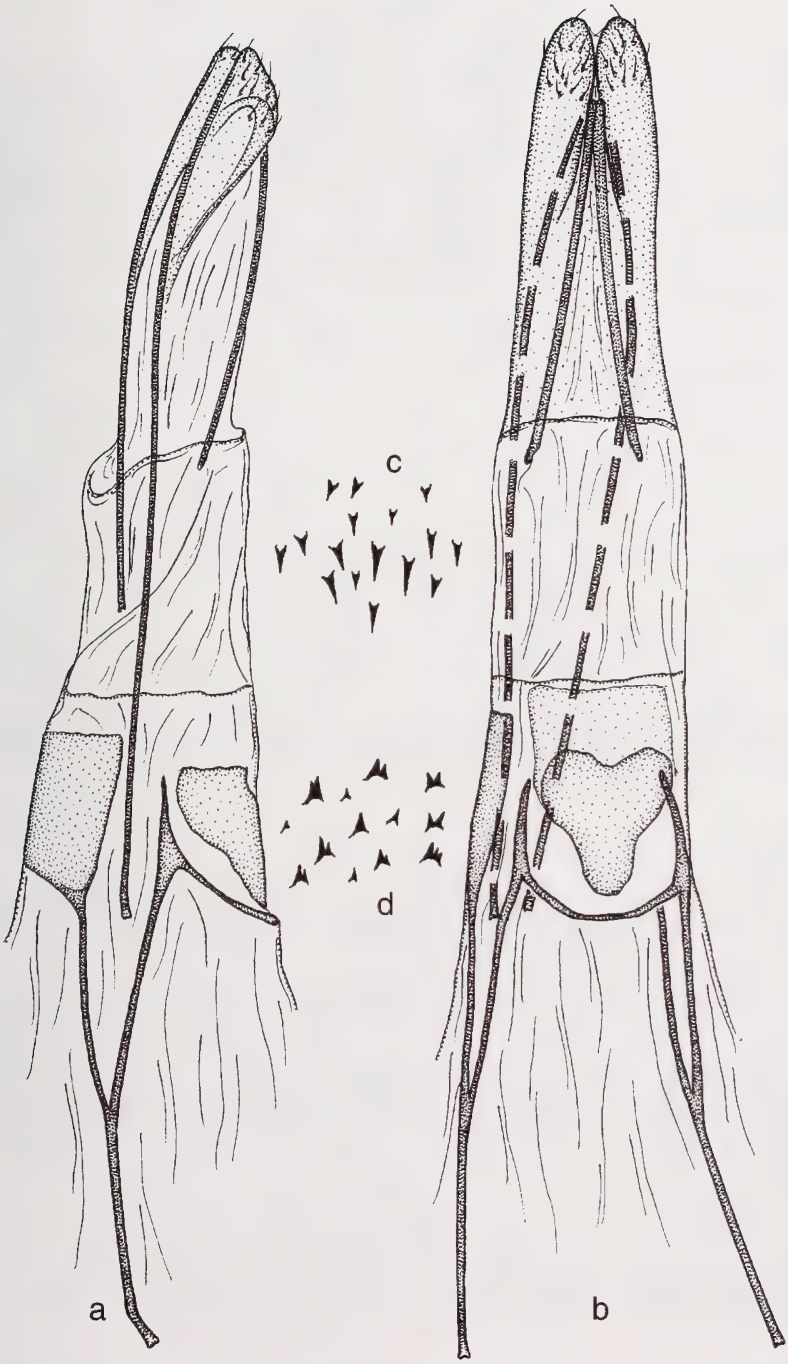
Fig. 10. *Dahlica karatyshica* sp. nov. paratype ♀: *a* – foreleg; *b* – midleg; *c* – hindleg.

From *P. thomanni* it differs by (1) lack of discal and anal dark spots on the forewing; (2) presence of only three radial veins on the forewing; (3) development of radial accessory cell on forewing in some individuals; (4) absence of more than four-dentate scales; (5) habitat: steppe xerophyte places, in contrast to mesophyte mountain woods (cf. Sauter, 1956).

From *D.* (?) *pallidella* it differs by (1) only three radial veins and two medial veins developed on forewing; (2) lack of intercalar cell on hindwings and only two medial veins being developed; (3) antennae exceeding half of forewing length; (4) space between eyes exceeding eye diameter; (5) labial palpi 2 times shorter than eye diameter; (6) tegumen with uncus domed (cf. Zagulajev, 1997).

→

Fig. 11. Female genitalia *Dahlica karatyshica* sp. nov. paratype ♀: *a* – lateral view; *b* – ventral view; *c* – intersegmental membrane thorns; *d* – thorns of postvaginal plate membraneous area.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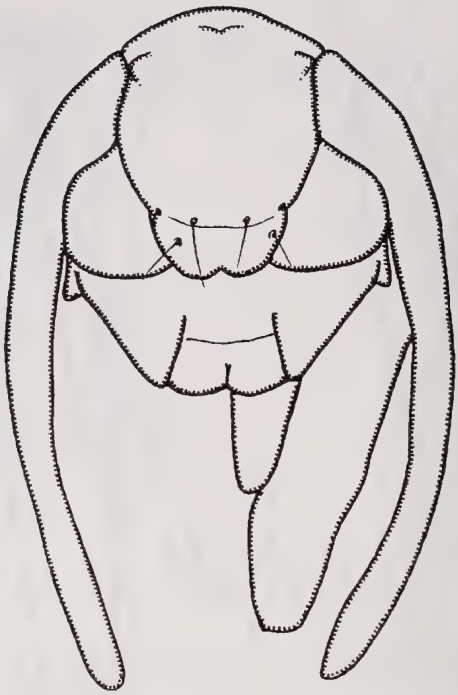

Fig. 12. *Dahlica karatyshica* sp. nov., ♀: pupal skin, anterior part, ventral view.

From *S. transsilvanica* it differs by the lack of the epiphysis and more than four-dentate scales, number of antennal segments 24–26 (cf. Herrmann & Weidlich, 1999).

From species with a genitalic index close to 1 (*Eosolenobia mannii* (Zeller, 1852), *Dahlica fumosella* (Heinemann, 1870), *D. larella* (Chretien, 1906), *D. incospicuella* (Stainton, 1843) (cf. Sauter, 1956; Arnscheid, 1985), *D. sauteri* (Hättenschwiler, 1977), *D. rianella* Hättenschwiler, 1981, *D. achajensis* (Sieder, 1966) and *D. colchica* (Kozlov, 1985) *D. karatyshica* sp. nov. is distinguished by its smaller size and the following characters: (1) venation; (2) number of antennal segments; (3) differences in cloaking scale classes; (4) number of tarsal segments in female; (5) shape of thorns on intersegmental membrane; (6) male and female genitalia structures.

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Unusual demonstration of autosomal dominant inheritance of the black coloration of one of America's swallowtails: F_2 broods of the hybrid *Papilio polyxenes asterius* with *Papilio machaon gorganus* (Papilionidae)

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Summary. From two *inter se* crossings of F_1 hybrids between the black American *Papilio polyxenes asterius* Cramer, 1782 (Papilionidae) and the yellow *P. machaon* Linnaeus, 1758 from Europe, 62 F_2 offspring were obtained, 79% being black and closely resembling *P. polyxenes asterius* and 21% yellow and almost identical with the European phenotypes of *P. machaon*. These percentages are consistent with the 3:1 ratio expected according to Mendel's law for the inheritance of an autosomal dominant trait. Earlier evidence of such inheritance was based on backcrossing only of black F_1 hybrids of the black American and the yellow European *P. machaon* strain with European *P. machaon*. One of the yellow F_2 offspring was backcrossed with a specimen of *P. machaon sphyrus* Hübner, 1823, generating 32 healthy and exclusively yellow *P. machaon*-like butterflies, by this confirming Mendel's law. Possible causes of breeding healthy F_2 generations are discussed. Keeping down pathogenic germs when rearing the broods appears to be the most likely explanation of our success.

Zusammenfassung. Aus zwei Kreuzungen der F_1-Hybriden zwischen schwarzen nordamerikanischen *Papilio polyxenes asterius* Cramer, 1782 und gelben *P. machaon* Linnaeus, 1758 aus Europa untereinander resultierten 62 Individuen einer F_2-Generation, von denen 79% schwarz gefärbt waren und *P. polyxenes asterius* sehr ähnelten, während 21% gelb gefärbt und nahezu mit europäischen Phänotypen von *P. machaon* identisch waren. Diese Prozentsätze sind konsistent mit einem bei autosomaler Vererbung eines dominanten Allels gemäß der Mendelschen Regeln erwarteten 3:1-Verhältnis der Phänotypen. Frühere Hinweise auf einen solchen Erbgang basierten ausschließlich auf Rückkreuzungen schwarzer F_1-Hybride des schwarzen amerikanischen und des gelben europäischen *P. machaon*-Stammes mit europäischen *P. machaon*. Einer der gelben F_2-Hybride wurde mit einem Falter von *P. machaon sphyrus* Hübner, 1823 rückgekreuzt; diese Nachkommenschaft bestand aus 32 gesunden, ausschließlich gelb gefärbten Individuen (Phänotyp wie *P. machaon*), womit die Vererbung der Flügelgrundfarbe nach Mendelschen Regeln wiederum bestätigt wird. Mögliche Gründe für die erfolgreiche Aufzucht lebensfähiger F_2-Generationen werden diskutiert. Die Unterdrückung der

Ausbreitung von Pathogenen während der Zucht erscheint als die wahrscheinlichste Erklärung für den beobachteten Erfolg.

Résumé. À partir de croisements entre hybrides F_1, issus d'accouplements entre la forme noire américaine *Papilio polyxenes asterius* Cramer, 1782 (Papilionidae) et la forme jaune européenne de *P. machaon* Linnaeus, 1758, une génération F_2 de 62 individus a été obtenue dont 79% sont noirs et ressemblent à *P. polyxenes asterius* et 21% jaunes et presque identiques au phénotype européen de *P. machaon*. Ces pourcentages concordent avec le rapport 3:1 attendu des lois de Mendel pour la transmission autosomique d'un caractère dominant. Les mises en évidence précédentes reposaient sur des rétrocroisements entre hybrides F_1 issus de la forme noire américaine et d'une souche européenne de *P. machaon* avec *P. machaon* d'Europe. Un exemplaire jaune de la génération F_2 fut croisé avec un exemplaire de *P. machaon sphyrus* Hübner, 1823, donnant 32 papillons vigoureux, exclusivement jaunes, du type *P. machaon*, confirmant ainsi les lois de Mendel. Les causes possibles de l'élevage convenable de générations F_2 sont discutées. L'absence de germes pathogènes lors des élevages apparaît la principale explication de notre succès.

Key words: Lepidoptera, *Papilio*, hybrids, crossing, coloration, inheritance, Europe, America.

Introduction

The black coloration of some American swallowtail butterflies (*P. polyxenes asterius* Cramer, 1782, *P. brevicauda* Saunders, 1869, *P.* '*nitra*' Edwards, 1883 — the latter is now considered as a genetically integrated morph within *P. zelicaon* Lucas, 1852, cf. Sperling, 1987) was repeatedly shown to be dominant over the yellow of others (*P. machaon* Linnaeus, 1758 and *P. zelicaon*), due to one single gene dominating over yellow (Clarke & Sheppard, 1955; Fisher, 1977; Blanchard & Descimon, 1988). Evidence for this was the 1:1 segregation of the F_2 generations of backcrosses between any random individual of an F_1 hybrid of the black/yellow cross with a genuine yellow individual. Confirmation was provided by the 3:1 ratio of black:yellow after sib matings of black individuals after one or more backcrosses with a yellow one. But sib matings of the F_1 of swallowtail hybrids remained unsuccessful as in the early fifties (Clarke *et al.*, 1953–1955; Aubert *et al.*, 1997); only after at least one backcross were fertile sib matings obtained (Clarke & Sheppard, 1955; Aubert *et al.*, 1997). In contrast to these results, the findings presented here demonstrate Mendelian autosomal dominance of black coloration by means of $F_1 \times F_1$ *inter se* matings. Possible explanations for our success will be discussed.

Material and methods

Pupae. Most of the non-hybrid pupae were obtained commercially, those of *P. machaon gorganus* Fruhstorfer, 1922 and *P. machaon sphyrus* Hübner, 1823 from caterpillars collected in the Czech Republic and Sicily, respectively. Only a few specimens of *P. machaon gorganus* came from caterpillars collected in Switzerland. Pupae of *P. polyxenes asterius* came from Brandon province, Manitoba, Canada.

Hand-pairing and oviposition. The technique of hand-pairing, consisting of holding the male and female butterflies together, in order that their genitalia interlock and insemination can take place (Clarke, 1952; Clarke & Sheppard, 1956), was applied by only one of us (EAL), with the following modifications: first, the butterflies were held with their wings downwards instead of upwards, which enhances the view of the genitalia; second, no rubbing after mutual approximation of the genitalia was applied. Under optimum conditions — healthy well-fed butterflies, a temperature of 20°C or higher, sunshine in the room where experiments took place, early afternoon (13:00–14:30) — the copulation usually took place within one minute and lasted 30–120 min. Before and after copulation, the butterflies were kept in round gauze-covered cages 65 cm wide and 85 cm high. In the event of successful mating eggs would be laid after an interval of 24 hours; for oviposition the females were placed in small cages and at the start of incoming daylight host plants were positioned in direct sunshine. The number of eggs deposited on the first day after mating easily reached 50, the total number being about 250.

Rearing the larvae. In view of the excellent pupae material obtained from outdoor caterpillar collection, eggs were not disinfected. Larvae, host plants and other material were treated only after thorough hand washing. L_1–L_3 were kept indoors, each larva on a separate twig of fennel seedlings (*Foeniculum vulgare*), preferably not more than 5 specimens per plant. Older caterpillars were either placed separately on one large fennel twig kept in water indoors or transported outdoors onto a 10 m^2 large bed of full-grown fennel covered with fine gauze for protection against predators. Contact between caterpillars was minimal due to the size of the bed and the plants. Signs of sickness were not observed and loss of caterpillars was negligible.

Results

In 1996 and 1997, hand-paired mating of the *P. machaon gorganus* male with the *P. polyxenes asterius* female and *vice versa* was obtained repeatedly, but not all females displayed oviposition of fertile eggs. Table 1 shows the results of two such crosses. The F_1 hybrid imagines all resembled *P. polyxenes asterius* with a normal sex ratio. F_1 *inter se* matings resulted in abundant oviposition by several females. Development and hatching of the L_1 larvae did not proceed normally however: in 1996, embryogenesis of the more than 100 eggs of one female stopped in about 70% of cases after they had turned brown, and of the remaining eggs which turned black only hatched 1:3, which means that only 10% came through. In 1997, the rate of successful hatching of the F_2 generation was substantially higher, with normal pupation of most caterpillars. The F_2 imagines eclosed after a few weeks, slightly more than $^3/_4$ of them again being practically indistinguishable from *P. polyxenes asterius*, those remaining closely resembling *P. machaon gorganus* (Table 2). The sex ratio was not different from 1:1. These figures are consistent with Mendelian-type autosomal dominant inheritance of the black coloration of *P. polyxenes asterius*. In a final experiment, one of the *machaon*-like males of the F_2 imagines was successfully mated with a female of *P. machaon sphyrus* (Eller, 1936).

Table 1. Results of backcrosses of F_1 imagines of the hybrid *P. machaon gorganus* ♂ × *P. polyxenes asterius* ♀ with a *P. machaon gorganus* ♂ and ♀, respectively.

	P. polyxenes asterius-like (black)		*P. machaon-like* (yellow)	
	♂	♀	♂	♀
m ♂ × (m/a) ♀	2	1	2	3
(m/a) ♂ × m ♀	5	7	1	5
Total number	15*		11*	
Percentage	58		42	

m – *P. machaon gorganus*; a – *P. polyxenes asterius*

* The deviation from the hypothetical expectation of 13:13 is so small that the probability of its occurring by chance is > 0.50 (chi-square, degrees of freedom = 1).

Table 2. Results of F_1 *inter se* matings of the hybrid *P. machaon gorganus* ♂ with *P. polyxenes asterius* ♀

	P. polyxenes asterius-like (black)		*P. machaon*-like (yellow)	
	♂	♀	♂	♀
1996	1	5	2	0
1997	23	20	3	8
Total number	49*		13*	
Percentage	79		21	

* The deviation from the hypothetical 46.5:15.5 is so small that the probability of its occurring by chance is > 0.50 (chi-square, degrees of freedom = 1).

In spite of the low vitality of the female, sufficient progeny were obtained to confirm Mendelian-type inheritance, all 32 imagines being yellow with a sex ratio of 1:1.3.

Discussion

The first report on spontaneous mating in captivity of a *P. machaon* male with a *P. polyxenes asterius* female appeared at the beginning of this century (Floersheim, 1910). The author, a well-known entomologist, observed the copulation in his butterfly house on July 29, 1908. He pointed out: "The day was a gloriously fine one, and the pairing, which took place about mid-day, lasted about four hours". The resulting hybrid imagines all closely resembled *P. polyxenes asterius*. The backcross with a *P. machaon* unfortunately ended in drowning of the female. More than 40 years later, after the introduction of hand-pairing (Clarke, 1952), the hybrid was obtained many times (Clarke & Knudson, 1953; Clarke & Sheppard, 1953), leading within a couple of years to the conclusion that black coloration of some of the American *P. machaon*-group species is determined by a single gene which is dominant over yellow (Clarke & Sheppard, 1955). This conclusion was, however, not based on straightforward *inter se* crossing of the F_1 hybrids, since the latter remained unsuccessful. It was deduced from the results of backcrossings which resulted in a black:yellow ratio of 1:1. More recently, this Mendelian-type dominance of black coloration was confirmed by backcrossing over four generations black F_1 females

with wild *P. machaon* males, which yielded imagines with a sex ratio opposite to that predicted by Haldane's Rule (Blanchard & Descimon, 1988; Sperling, 1993). This back-cross evidence of autosomal dominance of black over the yellow coloration was also shown by us (Table 1). Numbers were too small, however, to assess male:female ratios. But, contrary to other authors, we were also able to deduce the Mendelian-type autosomal dominant inheritance of black from offspring of *inter se* crossings of $F_1 \times F_1$ hybrids (Table 2). To corroborate the results, one of the yellow F_2 males was backcrossed with a *P. machaon sphyrus* female, yielding 32 healthy, exclusively yellow imagines.

We believe that our results of *inter se* crossing are indeed largely due to particularly healthy broods from outstandingly viable pupae as well as careful breeding under strictly aseptic conditions, handling the caterpillars as explained under *Methods*. Infection with viruses is a well-known complication of swallowtail rearing and is probably enhanced by inbreeding. Such an infection killed the whole F_2 brood in the laboratory of a Japanese researcher (Ae, 1964) and is obviously also well known to British scientists (Clarke & Larsen, 1986). This increased susceptibility to infection quite certainly explains the failure to obtain viable offspring of $F_1 \times F_1$ hybrid crossings of *P. machaon* with *P. hospiton* instead of *P. polyxenes asterius* (Clarke & Larsen, 1986; Aubert *et al.*, 1997). The French researchers also suspect another infectious agent, i.e., *Bacillus thuringiensis*, which is contained in insecticides thereby threatening caterpillar rearing.

Another cause of unsuccessful endeavours to obtain $F_1 \times F_1$ adults might be the fact that the other investigators worked with *P. machaon* from southern Europe, while our material came from Switzerland and from northern Europe. The British authors, in their early work in the fifties, used the insular *P. machaon sphyrus* from Malta (Clarke & Sheppard, 1955), the French investigators pupae from Cahors (Lot). Both report the presence of some caterpillars, the French even an L_4, all of which died, however. Later endeavours to obtain imagines from $F_1 \times F_1$ crosses in which *P. hospiton* was used instead of *P. polyxenes asterius* (Clarke & Larsen, 1986; Aubert *et al.*, 1997), were equally disappointing. The British authors observed a large variation in the hatching ratio of their

10 broods with low numbers of eggs, averaging only slightly more than 10, clearly pointing to low quality of the commercially obtained material. The hatching ratio varied from 0 to 56%, about 15% on the mean. Only one deformed female imago was obtained from two typical hybrid caterpillars. In comparison to the British, the French researchers obtained about 10 times as many eggs from 12 females. They report the occurrence of brown crowns on the eggs as a sign of embryonic development in about 10% of cases, and about 5% turned black, indicating full development of the caterpillar, none of which hatched, however. Since, in their later work, British researchers used *P. machaon* from Poland — the French did not specify — our supposition that *P. machaon* strains from southern Europe might be responsible for the low hatching percentages and brood failures becomes very unlikely. Equally improbable an explanation offers our modification of the handpairing method, the disappointing results of the French researchers having been obtained with broods from spontaneously copulating butterflies (Aubert *et al.*, 1997).

The above deliberations suggest that the success of obtaining healthy F_2 adults from *inter se* crossing of swallowtail butterfly hybrids is largely due to healthy livestock and germ-free handling of the imagines, ova and larvae. This hypothesis is supported by the report of an additional 8 healthy F_2 imagines in 1991 by another well-known, highly experienced and exceedingly precise amateur entomologist (Harbich, personal communication 1996).

Lastly, the results of an unintentional cross between a commercially obtained *P. polyxenes asterius* male (pupa provided by Mr John Reichel, Vancouver, CA) with a *P. machaon gorganus* female (Kutscher, 1992) are also interesting in this context. The fairly abundant offspring consisted of black as well as yellow specimens in a proportion of about 1:1, suggesting heterozygosity of the black male from Canada, possibly a natural hybrid specimen from the cross of one of the yellow American swallowtails in the Manitoba region. According to Sperling (1987 and personal communication 1998) Kutscher's specimens are, judged from colour photographs, "very reminiscent of '*kahli*' and '*avinoffi*' which are natural hybrids". As Brandon (Manitoba) was the origin of our *P. polyxenes asterius* pupae material and lies close to the *P. machaon* ×

P. polyxenes asterius swarm in central Manitoba, we cannot exclude the possibility that it contains some introgressed *machaon* genes (Sperling & Hansen, 1994). Relevant discussion is far beyond the scope of the present communication, however.

We conclude with the remark made by investigators of swallowtail butterflies of the Americas in the *Do it yourself* chapter of their recent handbook which states that: "Each cross needs its own tenderness that must be discovered empirically" (Tyler *et al.*, 1994).

New data (addendum)

In 1999, we repeated our experiments using Japanese *P. machaon hippocrates* Felder & Felder, 1864, kindly supplied by O. Yoshiaki (Tokyo), instead of the European *P. machaon gorganus*; the black American *P. polyxenes asterius* originated from the same area as in the earlier experiments. Hybridization was again easily achieved, resulting in 44 F_1 specimens, but there were only 10 females, that emerged only one to four weeks later than the males. This low number and late emergence of females interfered with *inter se* mating, and only two females produced enough eggs for meaningful statistical analysis. Of the 186 eggs deposited by the first one, 37 turned brown macroscopically. Inspection by means of a low-power binocular microscope identified another 20 with signs of embryonic pigmentation. Only one egg turned dark brown, which is usually observed shortly before the hatching of the larva. The latter did not come out, however. A second female produced 143 eggs, none of which displayed any signs of embryogenesis.

These additional observations suggest a larger phylogenetic distance between the American and the Japanese than between the American and the European swallowtail species. They indicate that the insular Maltesian material of *P. machaon sphyrus* used by the British researchers could at least partly have been responsible for the failure to produce viable offspring of the F_1 *inter se* crossings.

Clarke, Mittwoch & Traut (1977), in a study that we had overlooked so far, present data that agree remarkably with our own: from 32 matings of F_1 imagines, that are hybrids between a *P. machaon* male from Finland and a *P. polyxenes asterius* female from the east of the United States, these authors obtained 79 F_2 imagines of which 78% are black and 22% yellow, with a normal

sex ratio in both. Considering our results — 79% and 21% respectively — the close similarity is striking, the deviation from the expected 3:1 ratio in particular. Considering the observation by these authors that many larvae had died from disease, one is tempted to suppose that larvae predestined to develop into black imagines resist influences of nurture easier than those becoming yellow imagines.

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Eggshell fine structure of some species of Lithosiinae (Arctiidae) of Far East Russia

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Summary. Eggs of 7 species belonging to 6 genera of the Lithosiinae (Arctiidae) from the Primorskiy Krai (Far East Russia) were examined with the use of scanning electron microscopy. Descriptions and a comparative morphological analysis are provided for all of these species. The diagnostic characters for genera and species are chosen.

Zusammenfassung. Eier von 7 Arten aus 6 verschiedenen Gattungen der Lithosiinae (Arctiidae) aus dem Primorskiy Krai in Fernen Osten Rußlands wurden rasterelektronenmikroskopisch untersucht. Fur jede Art werden die Eier beschrieben und eine vergleichende morphologische Analyse gegeben. Diagnostische Merkmale für die Gattungen und Arten werden begrundet.

Résumé. Des œufs de 7 espèces, appartenant à 6 genres de Lithosiinae (Arctiidae), en provenance du Primorskiy Krai (Extrême Orient russe), ont été étudiés par moyen d'un microscope électronique à balayage. La description, ainsi que l'analyse comparative de la morphologie des œufs etudiés est présentée pour chacune de ces espèces. Des caractères diagnostiques des œufs pour les genres autant que les espèces sont établis.

Key words: Lithosiinae, Arctiidae, egg, exochorion sculpture, morphology, Far East Russia.

Introduction

The knowledge of the egg chorion of Arctiidae is still insufficient and fragmentary. The eggs of some members of the subfamily Arctiinae have been studied in some detail (Döring, 1955; Sarlet, 1967; Hinton, 1981; Orlando & Evoneo, 1984), whereas those of the subfamily Lithosiinae remain poorly studied (Döring, 1955; McFarland, 1972; Lafontaine *et al.*, 1982; García-Barros, 1985, 1986). Thus, the aim of our study was, even if partly, to fill this gap.

Material and Methods

The work is based on the original material collected by the authors in the Primorskiy Krai (Far East Russia). The eggs were

obtained from females captured in the field. The moths were placed into pasteboard boxes of a size of 100×90×50 mm, overlaid with lichens. Females also laid the eggs at random in the box, without choosing the special substrate. The eggs were examined with the use of scanning electron microscopy (SEM). Both dry egg chorions that were collected after hatching, and fresh specimens fixed with glutaraldehyde-osmium tetroxide or with alcohol were examined. Fixed eggs were first dehydrated in increasing acetone concentrations, and then critical point dried.

The Lithosiinae species were identified with the aid of Daniel (1939, 1951, 1952, 1954) and Inoue (1982). The systematic arrangement follows Dubatolov *et al.* (1993).

Description

Stigmatophora laecrita (Swinhoe, 1894)

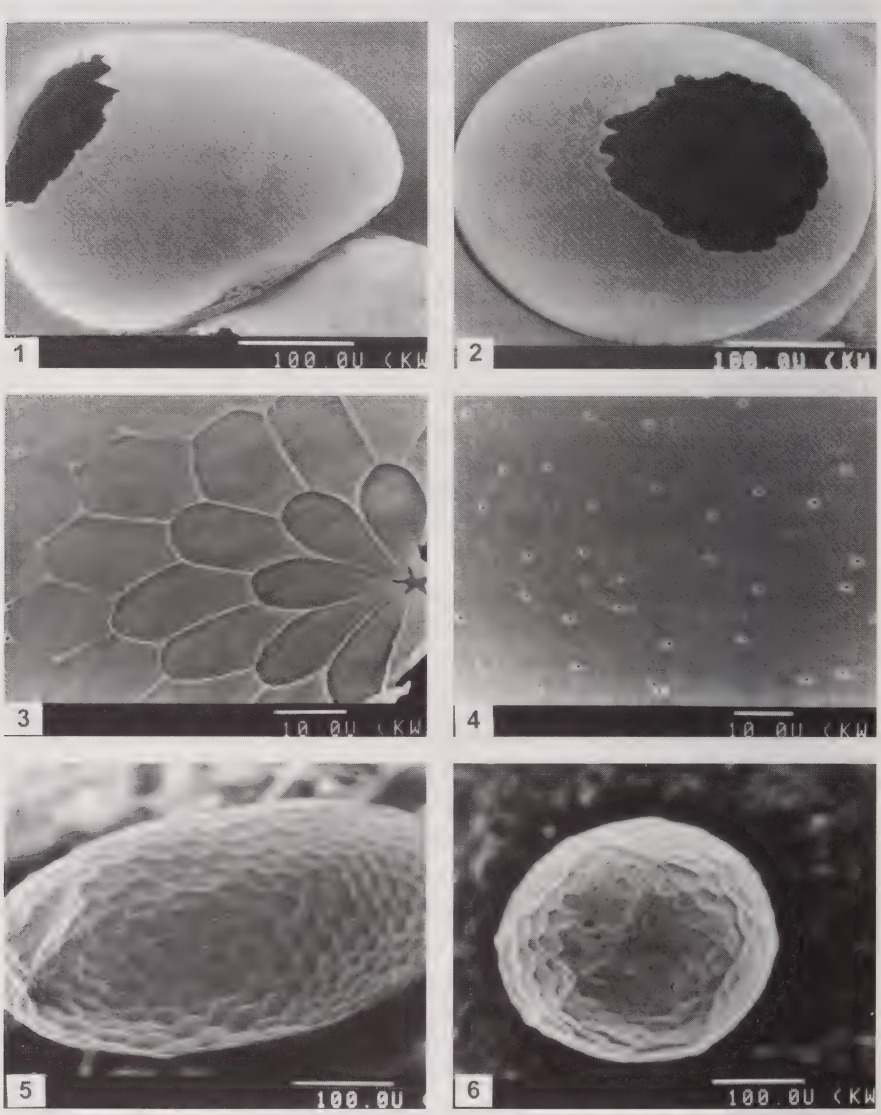
Material. 2♀, Russian Federation, Primorskiy Krai, Ussuriisky rayon, Gorno-Tayozhnaya Stantsia (Mountain-Taiga Station), 22.VII.1995 (eggs laid the same day; 10 eggs examined).

Egg spherical (Figs 1, 2), height 0.5 mm, diameter 0.5–0.55 mm. Chorion white, hyaline. Exochorion sculpture cellular in the micropylar area and with clearly marked aeropyles on the remaining egg surface. Micropylar area more clearly expressed, represented by 2–3 rows of polygonal cells (Figs 2, 3). Micropylar rosette (50.8–58.9 μm in diameter) with 10–11 petalled cells, 3 times longer than wide, joined along $^{2}/_{3}$–$^{3}/_{4}$ of their length. Central portion of the rosette like a small star-shaped depression (7.6–9.3 μm in diameter), 6.3–6.7 times smaller than rosette diameter, with 5 micropylar openings. The remaining egg surface smooth, with hardly noticeable cells but clearly expressed aeropyles, bordered by roller-like margins (9.8–12.0 μm in diameter) (Fig. 4).

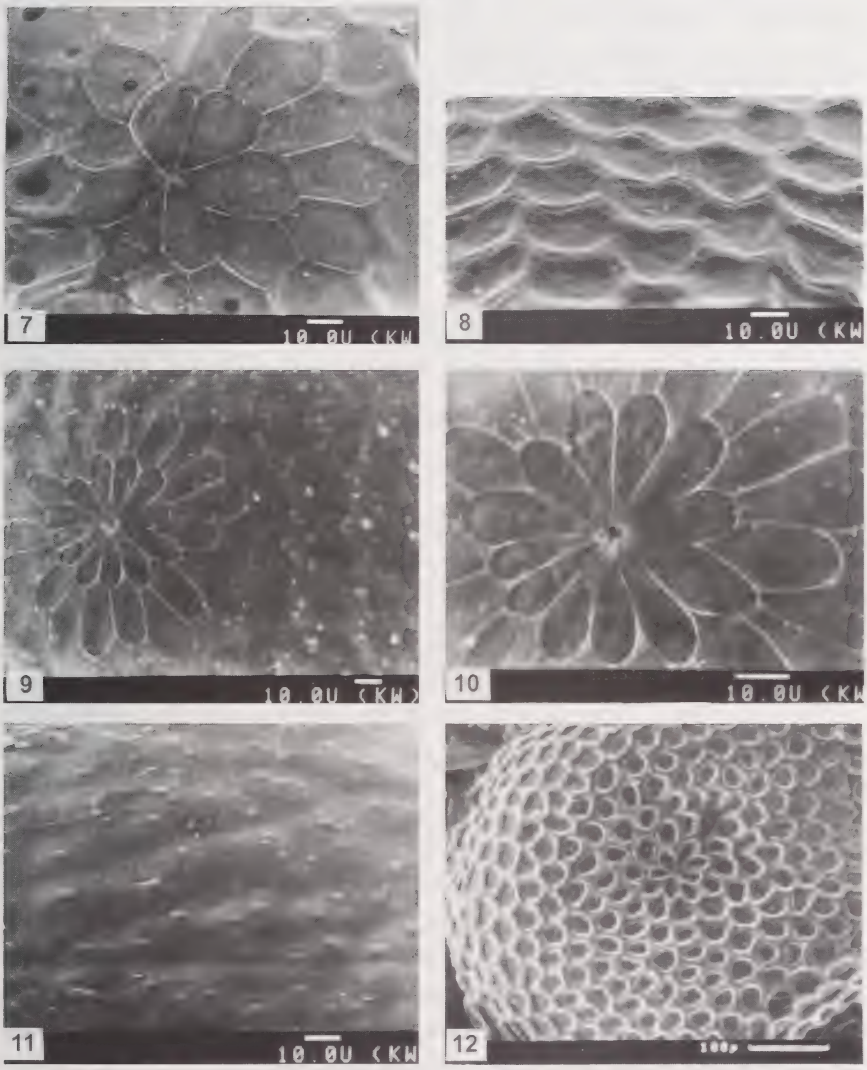
The larva nibbles out a large rounded opening at the apical area of the egg (Figs 1, 2). Caged females laid the eggs in single-layered clusters.

Miltochrista miniata rosaria Butler, 1877

Material. 4♀, Russian Federation, Primorskiy Krai, Ussuriisky rayon, Gorno-Tayozhnaya Stantsia (Mountain-Taiga Station), 6.VII., 8.VII.1995 (eggs laid the same days; 10 eggs examined).



Figs 1–6: 1 – *S. laecrita* (× 240), 2 – *S. laecrita* (× 240), 3 – *S. laecrita* (× 1500), 4 – *S. laecrita* (× 1200), 5 – *M. miniata rosaria* (× 220), 6 – *M. miniata rosaria* (× 200).



Figs 7–12: 7 – *M. miniata rosaria* (× 780), 8 – *M. miniata rosaria* (× 780), 9 – *P. staudingeri* (× 540), 10 – *P. staudingeri* (× 1100), 11 – *P. staudingeri* (× 720), 12 – *L. quadra* (× 190).

Egg high, oblong-ovoid, narrowing towards the base (Fig. 5). Height 0.7–0.85 mm, the largest width 0.3–0.45 mm. Egg pale orange. Chorion pale brown, hyaline. Exochorion sculpture clearly expressed, cellular (Fig. 8). Micropylar area represented by 2–3 rows of polygonal cells with flat cell margins (Figs 6, 7). Micropylar rosette (51.9–68.6 μm in diameter) with 7–8 wide cells, 1.5–2 times longer than wide, joining along $^1/_2$–$^2/_3$ of their length. Central portion of the rosette like a small star-shaped depression (4.6–7.1 μm in diameter), 9.7–11.2 times less than rosette diameter with 3–5 micropylar openings (Fig. 8). The cells across the remaining egg surface are concave and show sharply uplifted cell margins reaching 1.3–1.6 μm (Fig. 8).

The larva nibbles out a rounded opening at the apical area of the egg. In captivity, the eggs were laid in single-layered, loose clusters.

Paraona staudingeri Alpheraky, 1897

Material. 3♀, Russian Federation, Primorskiy Krai, Ussuriisky rayon, Gorno-Tayozhnaya Stantsia (Mountain-Taiga Station), 4, 9, 11.VII.1995 (eggs laid the same days; 10 eggs examined).

Egg spherical, height 0.5 mm, diameter 0.65 mm. Egg pale green, immediately before eclosion the egg is green. Chorion white, hyaline. Exochorion sculpture cellular in the micropylar area, remaining egg surface faintly folded and with moderately expressed aeropyles (Fig. 9). Micropylar area more clearly marked, represented with 2–3 rows of polygonal cells. Micropylar rosette (72.6–91.5 μm in diameter) with 11–13 cells, 2–3 times longer than wide, with margins fusing along $^2/_3$–$^3/_4$ of their length. Central portion of the rosette looking like a small star-shaped depression (5.0–6.3 μm in diameter), 14.5 times smaller than the rosette diameter, with 5 micropyles (Fig. 10). The remaining egg surface is slightly folded, and presents hardly noticeable cells with slender cell margins (0.2–0.3 μm) and more clearly identifiable aeropyles (1.95–2.9 μm in diameter) bordered by roller-like margins (Fig. 11).

The larva nibbles out a rounded opening at the apical area of the egg. Captive females laid the eggs in single-layered clusters.

Lithosia quadra (Linnaeus, 1758)

Material. 2♀, Russian Federation, Primorskiy Krai, Ussuriisky rayon, Gorno-Tayozhnaya Stantsia (Mountain-Taiga Station), 7.VII.1994 (eggs laid the same day; 10 eggs examined).

Egg spherical, height 0.5 mm, diameter 0.5–0.6 mm. Egg pale-green. Chorion white, hyaline. Exochorion sculpture clearly expressed, pitted-cellular (Fig. 12). Micropylar area represented by 2 rows of pitted cells. The micropylar area sculpture differs from that on the remaining egg surface by the lack of aeropyles (Fig. 13). Micropylar rosette (67.0–85.0 μm in diameter) with 8–9 wide cells, 1.5–2 times longer than wide, with margins fused along $^{2}/_{3}$–$^{3}/_{4}$ of their length. Central portion of the rosette looking like a small star-shaped depression (7.4–8.5 μm in diameter), 9–10 times smaller than the rosette diameter, with 5 micropyles (Fig. 14). Remaining egg surface with wide cell margins (10.2–10.8 μm) and minute aeropyles (2.8–3.1 μm in diameter) at the margin junctions (Fig. 15).

We consider this type of sculpture to be transitional between the pitted and the cellular sculpture. Its cells are not polygonal (as in the micropylar area or in the Notodontidae) (Dolinskaya, 1987a, b), but are rather rounded or oval with unclear margins.

The larva nibbles out a rounded opening at the apical area of the egg. Captive females laid the eggs in single-layered clusters.

Agylla gigantea (Oberthür, 1879), *A. collitoides* (Butler, 1885)

Material. *A. gigantea* 2♀, *A. collitoides* 2♀, Russian Federation, Primorskiy Krai, Ussuriisky rayon, Gorno-Tayozhnaya Stantsia (Mountain-Taiga Station), 4, 7.VII.1995 (eggs laid the same days; 10 eggs of each species examined).

Egg spherical, height 0.45–0.55 mm, diameter 0.55–0.7 mm. Egg of *A. collitoides* pale-green with faint bluish hue. Chorion white, hyaline. Exochorion sculpture cellular in the micropylar area and remaining egg surface folded with sharply expressed aeropyles united in the cells (Figs 16, 17, 20). Micropylar area represented by 2–3 rows of oblong polygonal cells (Fig. 18). Micropylar rosette (71.7–89.0 μm in diameter) with 11–13 petalled cells, 2–3 times longer than wide, joined along $^{2}/_{3}$–$^{3}/_{4}$ of their length. Central portion of rosette looking like a small star-shaped depression (8.2–

11.7 μm in diameter), 7.6–8.7 times smaller than rosette diameter, with 4–5 micropylar openings (Fig. 20). Remaining egg surface folded, looking sharply expressed, united in the cell aeropyles, bordered by large roller-like margins (4.0–5.7 μm in diameter) and with hardly noticeable cell margins (Figs 20, 21).

The larva nibbles out a rounded opening at the apical area of the egg. Captive females laid the eggs in single-layered clusters.

Note. No significant differences have been found between both species.

Eilema griseolum (Hübner, [1803])

Material. 3♀, Russian Federation, Primorskiy Krai, Ussuriisky rayon, Gorno-Tayozhnaya Stantsia (Mountain-Taiga Station), 16, 18, 23.VII.1995 (eggs laid the same days; 10 eggs examined).

Egg spherical, height 0.55–0.65 mm, diameter ca. 0.7 mm. Egg yellowish white. Chorion white, hyaline. Exochorion sculpture weakly expressed, consisting of hardly noticeable cells (Fig. 22). (Clear border between micropylar area and remaining egg surface lacking). There is a progressive transition in egg surface appearance from the micropylar area towards the egg equator. Sculpture more clearly defined in the first two rows (1–2 rows) of the micropylar area, then gradually disappearing (Fig. 23). Micropylar rosette (66.8–116.0 μm in diameter) with 14–17 petalled cells, 2–3 times longer than wide, joining along $^3/_4$ of their length. Central portion of rosette looking like a small depression (6.7–8.7 μm in diameter), 10.0–13.3 times smaller than rosette diameter, with 4–8 micropyles (Fig. 24).

The larva nibbles out a rounded opening at the apical area of the egg. Eggs laid in single-layered clusters.

Discussion

Based on the foregoing data, we can reach the following conclusions.

Eggs of the studied lichen moths are radial symmetric (upright type) with the micropylar area located at the pole opposite to the surface. Most of the studied Lithosiinae genera have spherical eggs (*Stigmatophora* Stgr., *Eilema* Hb., *Agylla* Wlk.), while oblong-ovoid-shaped eggs occur in *Miltochrista* Hb.. The size ratio of the

eggs varies: spherical — height 0.45–0.65 mm, diameter 0.5–0.7 μm; oblong-ovoid — height 0.7–0.85 μm, largest width 0.3–0.45 μm.

The coloration of the eggs depends of their contents, and is mostly of a greenish tint (*Paraona* Moore, *Lithosia quadra*, *A. collitoides*). Some species have yellowish-white (*E. griseolum*) or pale orange (*Miltochrista*) eggs. The chorion is hyaline, mostly white (otherwise pale brown: *Miltochrista*).

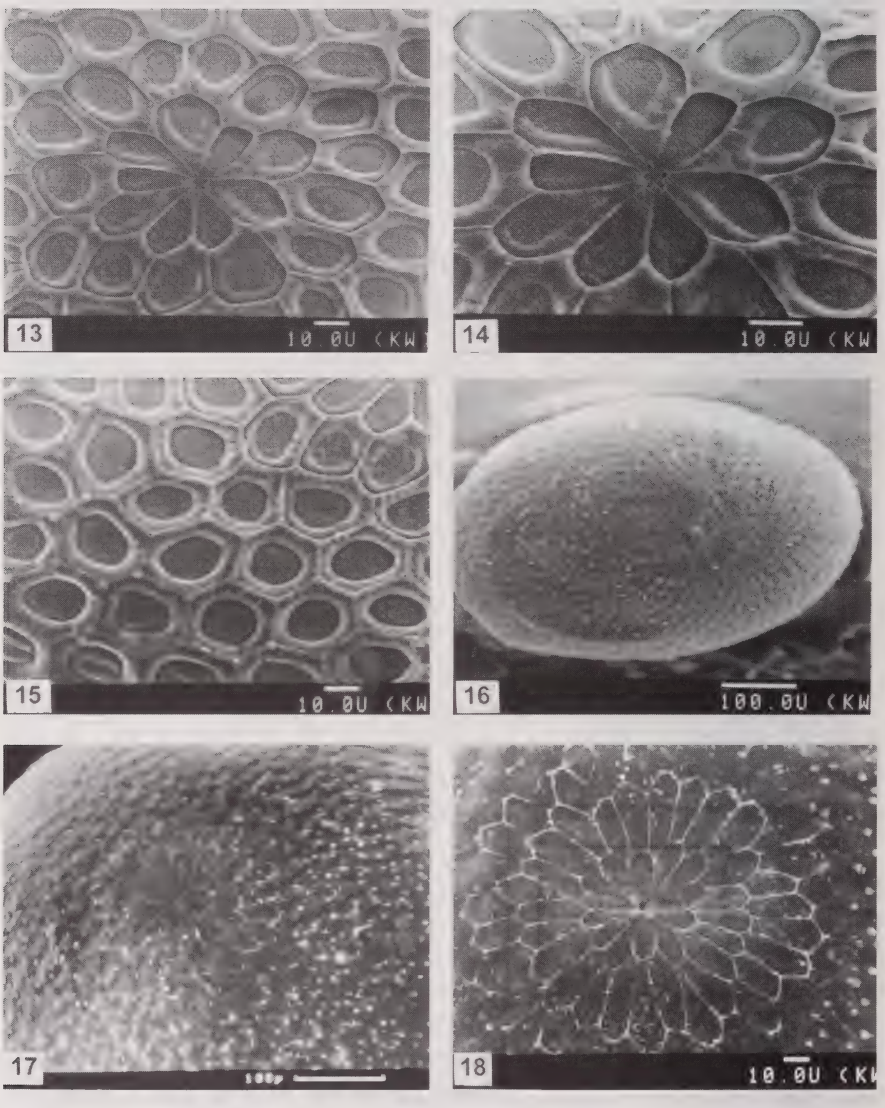
The exochorionic sculpture consists of a reticulate pattern, formed by the cell margins. It may be cellular over the whole egg surface, with sharply pronounced cell margins (*Miltochrista*) or cells developing only in the micropylar area, and the remaining egg surface with clearly expressed aeropyles united in the cells (*Stigmatophora, Paraona Agylla*). Sometimes cells are hardly noticeable (*Eilema*). The sculpture may also be peculiar, pitted-cellular (*L. quadra*). A similar type of sculpture is present in some species of the family Lasiocampidae (*Euthrix potatoria askoldensis* Oberth., *Paralebeda plagiera* Wlk. — authors' original data, unpublished yet).

The cell margins of some Lithosiinae eggs are very narrow (0.2–0.3 μm), weakly marked, or lacking. However, in some species they are sharply pronounced, reaching 1.3–1.6 mm (*Miltochrista*) or 10.2–10.8 μm (*L. quadra*).

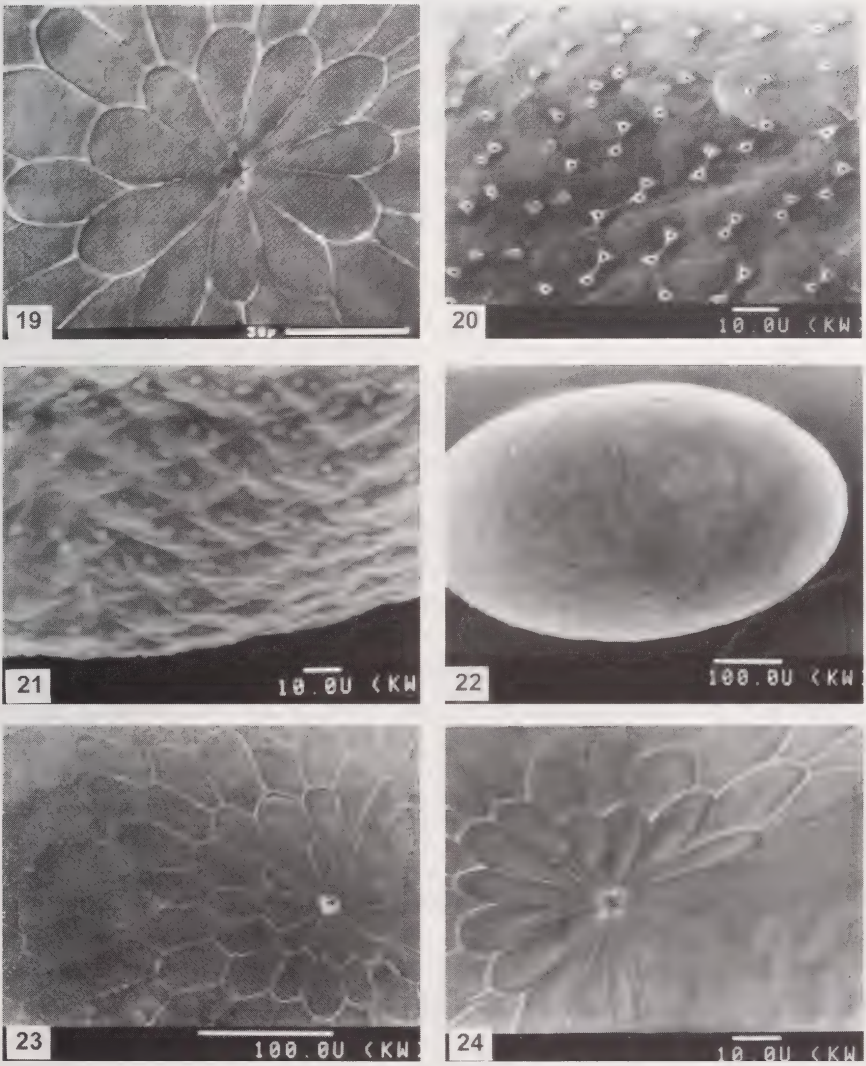
The aeropyles can be either sharply expressed, bordered with large roller-like margins (up to 4.0–5.7 μm in *Agylla* spp., or 9.8–12.0 μm in *Stigmatophora*), small (2.8–3.1 μm in *L. quadra*), or even not identifiable under SEM (as in *Eilema, Miltochrista*).

The micropylar area is represented by the rosette and 2–3 rows of polygonal cells with clearly expressed cell margins. The size of the micropylar rosette varies from 50.8–68.6 μm (*Stigmatophora*, *Miltochrista*) to 71.7–91.5 μm (*Agylla*, *Paraona*), and the number of rosette cells amounts to between 7–9 (*L. quadra, M. miniata rosaria*) and 14–17 (*Eilema*). The central portion of the rosette looks like a small star-shaped depression, 6.3–14.5 times smaller than the rosette diameter. The number of micropylar openings varies from 3 to 5.

Studied species of Lithosiinae are similar to Arctiinae (Pljushch & Dolinskaya, in press) in having the same oviposition behaviour in captivity. The eggs are laid in single-layer tight clusters, where



Figs 13–18: 13 – *L. quadra* (× 780), 14 – *L. quadra* (× 1200), 15 – *L. quadra* (× 780), 16 – *A. gigantea* (× 160), 17 – *A. gigantea* (× 210), 18 – *A. gigantea* (× 540).



Figs 19–24: 19 – *A. gigantea* (× 950), 20 – *A. collitoides* (× 1000), 21 – *A. collitoides* (× 780), 22 – *E. griseolum* (× 150), 23 – *E. griseolum* (× 280), 24 – *E. griseolum* (× 1000).

they are pressed to one another (*Stigmatophora, Paraona, Eilema, Lithosia, Agylla*) or not (*Miltochrista*).

The larva nibbles out a uniformly large, rounded opening at the apical (micropylar) area of the eggs, more rarely in the apical-lateral part.

Comparative table of the character states in studied species of Lithosiinae.

Species >	1	2	3	4	5	6
Shape (A – spherical, B – oblong-ovoid).	A	B	A	A	A	A
Egg colour (A - different green tints, B – pale orange, C – yellowish white)	-	B	A	A	A*	C
Chorion colour (A - white, B – pale brown)	A	B	A	A	A	A
Exochorion sculpture (A – cellular only in the micropylar area, the remaining surface looks like aeropyles, B – cellular over the whole egg surface, C – hardly noticeable cells, D - pitted-cellular	A	B	A	D	A	C
Egg margins (A - hardly noticeable, B – clearly noticeable)	A	B	A	B	A	A
Aeropyles (A – moderately or clearly noticeable, B – not visible, C – sharply noticeable)	A	B	A	A	C	B
Oviposition (A – the eggs pressed to one another, B – not pressed).	A	B	A	A	A	A

1 – *S. laecrita*, 2 – *M. miniata*, 3 – *P. staudingeri*, 4 – *L. quadra*, 5 – *A. gigantea* & *A. collitoides*, 6 – *E. griseolum*. * Available for *A. collitoides* only.

The comparative analysis pursued herein allows the evaluation of the following characters (Table).

1. The egg shape can be used to identify some genera (*Miltochrista*) or for grouping of the genera (see below).

2. Such characteristics as the way the larva nibbles out the eclosion opening and the oviposition behaviour in captivity are not as reliable as in tiger-moths.

3. The egg coloration can be used to identify species or genera.

4. The chorion coloration can be used to identify some genera (*Miltochrista*).

5. The exochorion sculpture allows to identify species and genera. It is useful for grouping of the genera (see below).

6. The characters of the micropylar area, such as the number of micropylar area rows, the number of rosette cells, and the number of micropylar openings, are the only quantitative characters representing a continuous clinal variation and are subject to intraspecific variation. Therefore only the extremes of a cline could appear useful for diagnostic purposes.

As a result, all examined genera of Lithosiinae may be placed in two groups according to the egg characters (with three subgroups in one of these):

(1) *Miltochrista* – egg oblong-ovoid, chorion pale-brown.

(2) *Stigmatophora, Paraona, Lithosia, Agylla* and *Eilema* – egg spherical, chorion white.

(a) *Lithosia* – exochorion sculpture pitted-cellular.

(b) *Stigmatophora, Paraona, Agylla* – exochorion sculpture looking like clearly expressed aeropyles united in the cells (*Stigmatophora* – exochorion sculpture smooth with clearly expressed aeropyles; *Paraona* – exochorion sculpture faintly folded with moderately expressed aeropyles; *Agylla* – exochorion sculpture clearly folded with sharply expressed aeropyles).

(c) *Eilema* – exochorion sculpture weakly expressed, looking like hardly noticeable cells, aeropyles not visible.

All the examined genera can be placed also into four groups according to the exochorion sculpture:

(1) Exochorion sculpture cellular only in the micropylar area, the remaining surface looking like clearly expressed aeropyles united in the cells – *Stigmatophora, Paraona, Agylla.*

(2) Exochorion sculpture cellular on the whole egg surface – *Miltochrista.*

(3) Exochorion sculpture pitted-cellular – *Lithosia.*

(4) Exochorion sculpture weakly expressed, looking like hardly noticeable cells – *Eilema.*

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New data on the ecology of *Thecla betulae* in the northeast of the Iberian Peninsula (Lycaenidae)

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Summary. Observations of 3rd and 4th instar larvae of *Thecla betulae* associated with two ant species, *Formica rufibarbis* and *Lasius grandis*, are reported for the first time under field conditions. New data on secondary host plants other than blackthorn (*Prunus spinosa*) are also given for two populations from the northeast of the Iberian Peninsula.

Zusammenfassung. Vergesellschaftungen der Raupen (3. und 4. Larvalstadium) von *Thecla betulae* mit zwei Ameisenarten, *Formica rufibarbis* und *Lasius grandis*, werden erstmalig aus dem Freiland beschrieben. Ferner werden für zwei Populationen aus dem Nordosten der Iberischen Halbinsel neue Beobachtungen zu sekundären Wirtspflanzen neben der Hauptnahrungspflanze der Raupen (Schlehe, *Prunus spinosa*) mitgeteilt.

Résumé. Des observations relatives aux 3ième et 4ième état larvaire de *Thecla betulae* en association avec deux espèces de fourmis, *Formica rufibarbis* et *Lasius grandis*, sont rapportées pour la première fois en conditions naturelles. De nouvelles données concernant des plantes-hôtes secondaires autres que le prunellier (*Prunus spinosa*) sont également présentées pour deux populations en provenance du nord-est de la péninsule ibérique.

Key words: Lycaenidae, *Thecla betulae*, myrmecophily, *Formica rufibarbis*, *Lasius grandis*, host plants, *Prunus domestica*, Catalonia, Iberian Peninsula.

Thecla betulae (Linnaeus, 1758) is an Eurasian lycaenid occurring in most of Europe and through Asia to Korea (Tolman & Lewington, 1997). In Spain it is restricted to the northern part of the country, from Galicia to Catalonia. The presence of isolated populations in Ávila and north Extremadura has been questioned recently by García-Villanueva *et al.* (1997) and, therefore, the southernmost Spanish strongholds are probably found in Catalonia, a region where its distribution is fairly well known (Viader, 1994; Stefanescu, 1997).

Most ecological knowledge on European populations of this species comes from extensive studies carried out by J. A. Thomas

in the early 70's (Thomas, 1974). Though additional data have been gathered by other authors since then (e.g. Ebert & Rennwald, 1991), the published information from southern European countries is almost inexistent.

In this note some new data on the ecology of *T. betulae* in the northeast of the Iberian Peninsula are given, in particular concerning its myrmecophilous behaviour and its feeding habits.

Myrmecophily in *T. betulae*

Many lycaenids associate with ants during their immature stages, though the degree of myrmecophily varies among the species (Fiedler, 1991a). In the Western Palaearctic region, however, the vast majority (more than 75%) of lycaenids are myrmecophilous, at least towards the end of the larval stage (Fiedler, 1991b).

The strength of ant-associations is related to the presence and secretory activity of so-called myrmecophilous organs: multiple minute pore cupola organs (PCOs), a dorsal nectar organ (DNO) and paired tentacle organs (TOs) (cf. Fiedler *et al.*, 1996). Both DNO and TOs are absent in so-called myrmecoxenous species (i.e., those not attended by ants in nature) and, conversely, re-inforce and stabilize the associations between larvae and ants in truly myrmecophilous lycaenids (Fiedler, 1991a; Fiedler *et al.*, 1996). PCOs occur in both lycaenid larvae and pupae of all studied European species (e.g. Malicky, 1969). PCOs produce secretions highly attractive to ants (possibly amino acids and pheromones; Fiedler *et al.*, 1996), though differences in the function of these organs have been found (Fiedler, 1991a).

Within the tribe Theclini, species in the predominantly Holarctic subtribe Thecliti (cf. Eliot, 1992) show reduced myrmecophilous organs. TOs are entirely missing and the presence of a fully functional DNO has not yet been confirmed without doubt for any Thecliti species (Fiedler, 1991a). In *Thecla betulae* only PCOs are present (Malicky, 1969; Fiedler, 1991b), and hence just a weakly myrmecophilous relationship is to be expected.

In fact, no records of ant-associations of *T. betulae* larvae under field conditions appear to have ever been published. In his thorough review, Fiedler (1991a) scored *T. betulae* as a weakly myrmecophilous species because, as indicated by Malicky (1969), some

old records vaguely stated that occasionally ant-associations seem to occur. However, intensive field work in England gave no additional evidence of this association (Thomas, 1974, 1975). On the other hand, fully grown larvae are known to be very attractive to a variety of ants in captivity (Taylor, 1915; Malicky, 1969; Fiedler, pers. comm.), and pupal ant-associations in the wild with *Lasius niger* or related taxa have already been described (Thomas, 1986; Thomas & Emmet, 1989).

In May 1998 and 1999, I was able to make some interesting observations of ant-associations of 3rd and 4th instar larvae of *T. betulae* under field conditions for the first time. On 29 April 1998 three larvae in their 3rd instar were found resting on the underside of leaves of two blackthorn bushes (*Prunus spinosa)* at Can Liro (Sant Pere de Vilamajor, Barcelona province, 41°41'16 N 2°23'07 E, 310 m), in NE Spain. Both blackthorns were ca. 1.5 m tall and grew in a hedgerow between cultivated fields. Egg-laying by *T. betulae* had been recorded on both bushes the previous September and October and seems to occur regularly every season (pers. obs.).

T. betulae larvae were monitored until they left for pupation by the end of May. On 16 May a last instar larva was seen attended by a worker of *Formica rufibarbis*. On 27 May another full-grown larva was found attended by two *Lasius grandis* workers (Fig. 1). In the first case, the association lasted only for a short time (approx. 1–2 min.), but on the second occasion *L. grandis* workers attended the larva for at least 15 min. and showed no signs of disturbance while the pictures were taken.

On 11 and 21 May 1999 a 3rd and a 4th instar larvae were found on another blackthorn in the same hedgerow. Both larvae were monitored almost daily until they left for pupation on 28 May and 2 June, respectively. The first larva was found attended by one or two *L. grandis* ants on four out of eight occasions while in the 3rd instar, and on eight out of ten occasions while in the 4th instar. The second larva was seen attended by *L. grandis* two out of ten times, but in one of these there were four mutualistic ants.

Thomas & Emmet (1989) suggested that the lack of field observations of ant-associations with *T. betulae* larvae may be a consequence of their habitat. In the temperate-zone woodlands the number of ants foraging on bushes and lower trees is limited and thus

Fig. 1. Fourth instar larva of *Thecla betulae* tended by two *Lasius grandis* workers (Photograph: M. Miralles).

the probability of encounters between ants and *T. betulae* caterpillars is much reduced (see also Malicky, 1969 and Fiedler, 1991a for a similar but more general reasoning). In the area where the forementioned observations were made, however, blackthorns and a nearby peach tree *Prunus persica* were intensively visited by *Lasius grandis* and *Formica rufibarbis* throughout April–May and June (but not later on in the season), attracted by aphids that concentrated by that time on the underside of some young leaves and possibly also by extrafloral nectaries occurring on these plants (cf. Tilman, 1978). My own data seem to indicate that these associations may be quite common, though full-grown larvae have been found several times at the same hedgerow and also at nearby places without mutualistic ants.

Host plant use

Most European records mention blackthorn *Prunus spinosa* as the most usual food plant of *T. betulae* (e.g. Tolman & Lewington, 1997) and in Spain this was the only species recorded so far (Munguira *et al.*, 1997).

In 1998, however, one larva and several eggs were found on plum *Prunus domestica* at two different sites. On 23 April a 3rd instar larva was found on the underside of a leaf in Can Riera de Vilardell, an agricultural area surrounded by evergreen oak forest near the village of Sant Celoni, Barcelona province (41°41' N 2°32' E, 250 m). In addition, during the winter, several eggs were found on various plums growing in the vicinity of Can Liro.

Finally, on 7th October 1995, also at Can Liro, a female was seen in oviposition behaviour on a peach tree *Prunus persica*. She alighted on the tree and immediately started walking on a twig, tapping with her forelegs and antennae. However, no egg was finally laid. Although no actual oviposition record was obtained, the distinctive behaviour shown by this female seems indicative that peach trees may be sometimes used as a secondary host plant in this population.

These observations confirm that several woody plant species other than blackthorn are used as host plants by *T. betulae* in Europe. In Germany, for example, *Prunus domestica* and other related shrubs and trees of the family Rosaceae (*Prunus insititia*,

P. avium, *P. padus*, *Crataegus monogyna* and *Chaenomeles japonica*) had already been cited as food plants (Ebert & Rennwald, 1991; K. Fiedler, unpubl. data). In Britain, *P. insititia* had also been recorded as a food plant in the wild (Thomas & Emmet, 1989), and a couple of other Rosaceae species (mostly in *Prunus* and related genera) are documented as host plants of Eastern Asian populations (e.g. Dantchenko *et al.*, 1995).

Moreover, there is at least one confirmed record of oviposition on *Betula pendula* (Betulaceae) from Germany (Ebert & Rennwald, 1991), that indicates that even plants not belonging to the Rosaceae can be occasionally selected by ovipositing females. This record, together with others obtained from the Russian and Japanese literature (eggs and/or larvae found on several plants belonging to the Betulaceae, Caprifoliaceae, Corylaceae, Grossulariaceae and Salicaceae: Lukhtanov & Lukhtanov, 1994; Korshunov & Gorbunov, 1995) led Fiedler (1991a) to categorize *T. betulae* as a moderately polyphagous species.

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The karyotype and chromosome number of *Polyommatus buzulmavi* (Lycaenidae)

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Summary. The karyotype of *Polyommatus buzulmavi* Carbonell, 1992 from the Dez Valley (Turkey, Hakkari province) is described and figured: the haploid chromosome number $n = 45$ has been determined and several B-chromosomes have been found. This number departs significantly from the number $n = 23$, which has been found in several other species of *Polyommatus* s. str. so far.

Zusammenfassung. Der Karyotyp von *Polyommatus buzulmavi* Carbonell, 1992 aus dem Dez Tal (Türkei, Hakkari Provinz) wird beschrieben und abgebildet. Als haploide Chromosomenzahl wurde $n = 45$ festgestellt und es wurden mehrere zusätzliche B-Chromosomen gefunden. Diese Zahl unterscheidet sich erheblich von der Zahl $n = 23$ bei anderen Arten der Gattung *Polyommatus* s. str.

Résumé. Le caryotype de *Polyommatus buzulmavi* Carbonell, 1992 de la vallée du Dez (Turquie, province de Hakkari), est décrit et figuré: le nombre haploïde de chromosomes $n = 45$ a été déterminé et plusieurs chromosomes surnuméraires ont été trouvés. Ce nombre diffère de façon significative du nombre $n = 23$, qui a été trouvé chez plusieurs autres espèces appartenant au genre *Polyommatus* s. str.

Key words: Lycaenidae, *Polyommatus buzulmavi*, karyotype, Turkey.

Introduction

Carbonell ([1992]: 223–224) described *Polyommatus buzulmavi* after a series collected by himself and a few colleagues in the Dez and Zap Valleys, Hakkari province, Turkey. This butterfly can easily be told apart from the syntopic *Polyommatus icarus* (Rottemburg, 1775), being highly characteristic by its much larger size, its lighter blue colour and the light grey colour on the underside. In the same paper, on pp. 224–226, Carbonell described a distinct subspecies, *Polyommatus buzulmavi narlica*, after six males collected about 10 km N. of Çatak, Van province, Turkey, and list-

ed a series of characters, purported to differentiate the Çatak material from that from the Dez Valley. De Prins & van der Poorten (1993: 12–13) described the female of this species and expressed doubts about the validity of the distinction of *narlica*. They further placed *P. buzulmavi* in the subgenus *Meleageria* de Sagarra, 1925.

Hesselbarth *et al.* (1995: 684–685) were able to examine larger series of *P. buzulmavi* from both Hakkari and Van provinces and found the characters, purported to differentiate *P. buzulmavi narlica*, to fall within the range of variation of nominotypical *buzulmavi*: consequently they established the former name as a junior subjective synonym of the latter one. They further placed this taxon again in subgenus *Polyommatus* Latreille, 1804. Both external and genitalic characters support its placement within last-named subgenus (J.G. Coutsis, pers. comm.).

The biology of this taxon is still unknown, and so was, up to the present, its karyotype and chromosome number.

Material and methods

On 23.VII.1999, the second author of the present publication collected one single topotypical male of *P. buzulmavi* for karyological study. The testes were fixed a few hours after collecting, when the butterfly was still alive and, later on, a slide mount (AO 99173) was prepared by the first author, who also made the photographs reproduced here as Figs 1–3 (methodology followed as described in detail in Olivier *et al.*, 1999). The photo negatives were scanned and processed with Corel Photo Paint. The specimen and the slide mount are deposited in the Vlaamse Lepidoptera Collectie Antwerpen (VLCA).

Karyotype and chromosome number of *Polyommatus buzulmavi*

The testes of the only specimen gave good results. Nine cysts were found that contained spermatocyte divisions. 32 cells were at the *M*-I stage, 2 cells at the *M*-II stage and 11 cells were in the early prometaphase. The chromosomes of 8 *M*-I cells were counted and 4 *M*-I plates were photographed. The karyotype of *P. buzulmavi* is asymmetric (Fig. 1). Bivalents fall into two main groups, that are

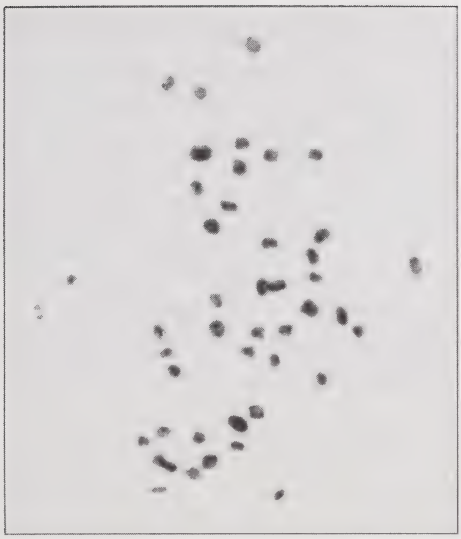

Fig. 1. Karyotype of *Polyommatus buzulmavi*, slide AO 99173, *M*-I, *n* = 45, Turkey, Hakkari province, Dez Valley, 1500–1700 m, 23.VII.1999, leg. A. Olivier (VLCA).

Fig. 2. Karyotype of *Polyommatus buzulmavi*, slide AO 99173, *M*-I, *n* = 45 + B" + 2 B', the arrow indicates the B bivalent, Turkey, Hakkari province, Dez Valley, 1500–1700 m, 23.VII.1999, leg. A. Olivier (VLCA).

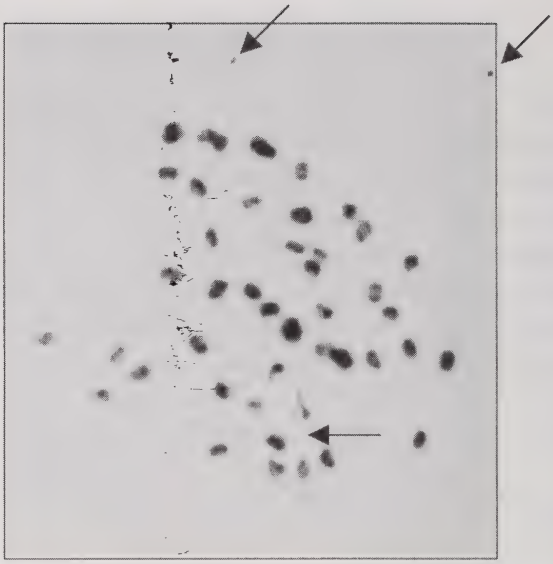

Fig. 3. Karyotype of *Polyommatus buzulmavi*, slide AO 99173, *M*-I, $n = 45 + B'' + 2\ B'$, the lower arrow indicates the B bivalent, the two upper arrows point at two additional chromatine elements, Turkey, Hakkari province, Dez Valley, 1500–1700 m, 23.VII.1999, leg. A. Olivier (VLCA).

almost equal in number: one group consists of comparatively large bivalents which show a gradually decreasing series in size, the other group of medium-sized bivalents that are almost equal in size. The largest bivalents are situated more or less close to the center of the metaphase plate, the medium ones usually surrounding these. Besides the large and medium-sized bivalents, one small bivalent is present, which is about half of the size of the smallest medium sized bivalent and which occupies about 1/5 of the largest bivalent area. The two largest bivalents, as well as the smallest one, are distinguishable and hence can serve as the markers for the karyotype. The largest bivalent is rounded, heteropycnotic and usually situated in the center of the metaphase plate. The C-heterochromatin parts are in the centre of the bivalent, the euchromatin parts at the sides. The second large bivalent is dumb-bell shaped and, contrary to the first one, shows more C-heterochromatin at the edges and

much less in the central part of the bivalent. The smallest bivalent in two metaphase plates showed a high degree of contraction and was sharply contrasting in adhesion of dye. It was situated apart from the rest of the bivalents, almost at the edge of the metaphase plate. Both plates observed were in the early metaphase stage. In the rest of the metaphases the smallest bivalent did not show such a dense contraction, although it was usually attached to one large bivalent by telomeric parts. The association of those two bivalents resulted in a V or irregular U shape. It seems likely that the smallest bivalent is the sex bivalent, but in order to establish that with certainty, the karyotype of the female *P. buzulmavi* needs to be studied. The remaining bivalents are rounded or elongated and usually isopycnotic.

Special attention was paid to B-chromosomes, that were found in 6 metaphase plates. Usually, there were two small additional euchromatic univalents attached to A-bivalents. Due to that, A-bivalents had a parachute-like shape. However, two metaphase plates showed another pattern of B-chromosomes. One small, rounded B-bivalent was found, which consists almost entirely of C-heterochromatin and was situated at the edge of the metaphase plate (Fig. 2). Those two plates also had two B-univalents, which were situated rather close to each other. The chromosome number of those two metaphase plates is n = 45 + B" + 2 B'. One metaphase plate showed an even more complicated pattern. At a short distance from the metaphase plate, two small microelements of C-heterochromatin of bivalent shape and approximately 5 tiny univalent elements were situated: these could be additional B-chromosomes as well (Fig. 3). However, their location rather apart from the main metaphase plate keeps us from including these in the karyotype description of this species. Despite varying numbers of B-chromosomes or chromatin elements, the number of A-bivalents remained constantly at n = 45.

Discussion

Interestingly, the chromosome number of *P. buzulmavi* is very different from that of *P. icarus*, *P. juno* Hemming, 1933, *P. eros eros* (Ochsenheimer, 1808), *P. eros yildizae* Koçak, 1977 and

P. menelaos Brown, 1976, that all have a haploid chromosome number of $n = 23$ (Robinson, 1971, 1990 and references therein; Hesselbarth *et al.*, 1995 and references therein; Larsen, 1975; Brown, 1976). It is worth emphasizing that $n = 23$ (–24) appears to be the modal number for the Lycaenidae (including Polyommatines, Lycaenines and "Theclines"), thus conforming to the ancestral condition (Lorković, 1990). Hence *P. buzulmavi* represents a derived character state with regard to chromosome number. Moreover, the approximate doubling of the chromosome number in one of two evidently closely related species is suggestive of chromosome fissions. Further karyological studies on Central Asian *Polyommatus* s. str. species-group taxa appear highly desirable.

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1983) and *Polyommatus buzulmavi* Carbonell, 1992 (Lepidoptera: Lycaenidae). — *Phegea* 21(1): 11–16, 2 col.pls.

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Axel Scholz
(11.6.1957–30.6.1998)

Während einer Exkursion in der Steiermark verunglückte Axel Scholz am 30.6.1998 am Gulsenberg bei Preg a. d. Mur tödlich. Mit ihm verliert die Entomologie einen versierten Kenner der Mikrolepidopteren, der gerade erst begann, seine vielfältigen Kenntnisse zur Systematik und vor allen Dingen zur Biologie der europäischen Kleinschmetterlinge der Fachwelt mitzuteilen.

Axel Scholz wurde am 11. Juni 1957 in Ulm geboren. Nach dem Besuch der Volksschule und des Gymnasiums in Laupheim legte er 1977 das Abitur ab und begann 1979, nach 2-jährigem Dienst bei der Bundeswehr in Mittenwald, mit den Biologie- und Sportstudium an der TH Darmstadt. Im Jahre 1984 erfolgte ein Wechsel zur Deutschen Sporthochschule in Köln (Studiengang Diplomsportlehrer), verbunden mit mehreren Urlaubssemestern zur Finanzierung des Studiums. Wegen der schlechten Aussichten auf eine Anstellung unterbrach er 1991 das Studium und begann eine Tätigkeit als Angestellter in einer Arzneimittelfirma im

Bereich Analytik, die er bis zu seinem Tode ausführte. Parallel dazu begann er 1993 an der Universität Augsburg einen Studiengang Hauptschule in den Fächern Biologie, Sport und Deutsch, für den im Frühjahr 1999 der Abschluß geplant war. Leider war es ihm nicht mehr vergönnt, in dem von ihm gewählten Beruf tätig zu sein.

Die Liebe zur Natur wurde bei Axel Scholz schon im Kindesalter im Elternhaus geweckt, mit seinem leider schon 1965 verstorbenen Vater wurden erste Sammelversuche unternommen. Sehr früh eignete er sich sehr gute botanische Kenntnisse an, so daß er sich bevorzugt mit der Biologie der Lepidopteren befaßte, mit einem Gebiet, auf dem noch so Vieles Neue zu entdecken war. Auch seine letzte Exkursion war den Minierern gewidmet, die Suche nach den Minen von *Lunakia alyssella* am typischen Fundort war erfolgreich, wie die Blattminen an *Alyssum montanum presseckeri* in seinem Exkursionsgepäck belegen. Außerordentlich förderlich für seine Interessen wurde der seit 1988 währende Briefwechsel mit Dr. J. Klimesch (1902–1997). Durch ihn erhielt er zahlreiche Anregungen zur Beschäftigung mit den minierenden Vertretern der Mikrolepidopteren, vor allem mit den Nepticuliden. Ein weiteres wichtiges Ereignis in seiner entomologischen Entwicklung war die Bekanntschaft mit E. Jäckh (1902–1993). Durch ihn erhielt er neben zahlreichen Hinweisen aus dem reichen Erfahrungsschatz als unerläßliche Hilfsmittel eine Reihe wichtiger entomologischer Literatur, die Grundlage seiner Bibliothek bildete. Herr Jäckh war es auch, der ihn mit den Alucitidae vertraut machte, mit einer Familie, über die dieser schon viele Jahre gearbeitet hatte. Herrn Scholz ist es zu danken, daß dieser Kenntnisschatz nicht verlorenging, in der 1994 erschienenen gemeinsamen Revision wurden die Ergebnisse der Fachwelt vorgestellt.

Sein großes handwerkliches Geschick sowie seine ihm eigene Exaktheit befähigten ihn, das auf Exkursionen oder durch Zuchten erlangte Faltermaterial in beinahe unnachahmlicher Art und Weise zu präparieren. Seine Sammlung ist nicht nur eine Quelle wertvoller wissenschaftlicher Informationen sondern auch ein ästhetischer Genuß. Diese Exaktheit und Präzision der Beobachtung war es auch, die ihn auf Dinge aufmerksam werden ließ, die Andere bislang übersehen hatten. Ein typisches Beispiel hierfür ist seine Entdeckung, daß sich unter dem Namen *Epermenia illigerella* eine weitere Art verbirgt, - *Epermenia falciformis*. Durch die Arbeit an

own classification'. After a brief Introduction, in which some problems with current classification systems are briefly reviewed and species totals for superfamilies of Lepidoptera are presented on a table, the evolution of the Lepidoptera is briefly outlined, with a diagram depicting a hypothetical ancestral moth. A schematic phylogeny of lepidopteran superfamilies and several schemes for constituent families are then presented. Then follows a brief historical review of Lepidoptera classifications, after which the author presents his own classification of the Lepidoptera. Subsequently, the author presents an Index to Families and Higher Categories, an Index to Common Names of Families and various keys to Lepidoptera Families, interspersed with various drawings of exo- and endomorphological characters. The book ends with a References section and an Index. The overall impression it leaves, however, is that of a courageous but rather amateuristic enterprise. In any case, its impact will painfully be overshadowed by the recently published 'Lepidoptera, Moths and Butterflies. Volume 1: Evolution, Systematics, and Biogeography', edited by N. P. Kristensen in the series 'Handbuch der Zoologie' (reviewed in *Nota lepid.* **22**(4): 317–322).

Alain Olivier

Hall, Jason P. W.: A contribution to Riodinid systematics (Lepidoptera: Riodinidae).
21.5 × 28 cm, 42 pp., *Tropical Lepidoptera* **9**(Suppl. 1) Published by Association for Tropical Lepidoptera, Inc. Tel. (352) 392-5894 – fax: (352) 392-0479; e-mail: jbhatl@aol.com; homepage: http://www.troplep.org, 30.XI.1998. ISSN 1048-8138. To be ordered from the publisher.

This special issue of *Tropical Lepidoptera* consists of four papers (co-)authored by Jason P. W. Hall. The first one, 'A Review of the Genus *Sarota* (Riodinidae)' includes, along with a brief characterization of the genus, a brief overview of the biology, biogeography and taxonomic history of its component species, a key to the identification of adults, illustrations of all known species and subspecies (including many type specimens) with accompanying taxonomic notes and the descriptions of five new species and two new subspecies. Twenty species are recognised. Neotypes are designated for two species, one tribe is synonymised with another tribe and a cladogram based on a small character matrix is used to illustrate generic relationships within the more inclusive, newly conceived tribe. The second paper, 'Three new species of Riodinini from the cloud forests of Ecuador (Lepidoptera: Riodinidae)', further includes the illustrations of some related taxa, two new combinations and one new synonym. The titles of the third — 'Nine new species and one new subspecies of *Euselasia* from Ecuador (Lepidoptera: Riodinidae)' — and fourth paper, 'A new genus of Riodinid, with a new species from Panama (Lepidoptera: Riodinidae: Nymphidiini' summarize well their content.

Alain Olivier

Davis, Donald R.: Lepidopterorum Catalogus (New Series) Volume 5. Yponomeutoidea. Fascicle 48. Ochsenheimeriidae.
21.5 × 28 cm, VIII + 12 pp. Edited by J. B. Heppner. Published by Scientific Publishers, Inc., P. O. Box 15718, Gainesville, FL 32604 USA. 1998. ISBN 0-945417-55-1 (Fasc. 48). — ISBN 0-945417-50-0 (Series). To be ordered from the publisher.

In a Preface, the family is briefly introduced. After a map showing the world distribution of the overwhelmingly Palaearctic family of the Ochsenheimeriidae, and a generic synopsis, a catalog of the 17 currently recognised species, placed in two genera, is presented and six species are depicted on one black-and-white plate. Brief notes are added for three of these. Then comes a References list (102 entries), a host plant index, an index to species and an index to genera.

Alain Olivier

Heppner, John B.: Lepidopterorum Catalogus (New Series) Volume 8. Pterophoroidea. Fascicle 61. Tineodidae.
21.5 × 28 cm, VIII + 8 pp. Edited by J. B. Heppner. Published by Scientific Publishers, Inc., P. O. Box 15718, Gainesville, FL 32604 USA. 1998. ISBN 0-945417-58-6 (Fasc. 48). — ISBN 0-945417-50-0 (Series). To be ordered from the publisher.

In a Preface, the family is briefly introduced. After a map showing the world distribution of the exclusively Australian family of the Tineodidae, and a generic synopsis, a catalog of the 10 currently recognised species, placed in seven genera, is presented and four species are depicted on one black-and-white plate. Then comes a References list (23 entries), a host plant index, an index to species and an index to genera.

Alain Olivier

Scoble, Malcolm J.: Lepidopterorum Catalogus (New Series) Volume 96. Geometroidea. Fascicle 93. Hedylidae.
21.5 × 28 cm, VIII + 8 pp. Edited by J. B. Heppner. Published by Scientific Publishers, Inc., P. O. Box 15718, Gainesville, FL 32604 USA. 1998. ISBN 0-945417-66-7 (Fasc. 93). — ISBN 0-945417-50-0 (Series). To be ordered from the publisher.

In a Preface, the family is briefly introduced. After a map showing the world distribution of the exclusively Neotropical family of the Hedylidae, and a generic synopsis (only one genus, *Macrosoma* Hübner, 1818, is recognized), a catalog of the 35 currently recognised species is presented and eleven representative species are depicted on one black-and-white plate. Then comes a References list (47 entries), a host plant index, an index to species and an index to genera.

Alain Olivier

Hall, Jason P. W.: A Revision of the Genus *Theope*, its Systematics and Biology (Lepidoptera: Riodinidae: Nymphidiini).
21.5 × 28 cm, VIII + 127 pp., 274 figs. (incl. 9 plates with figs 10–77), 7 tables. Paperback. Published by Scientific Publishers, Inc., P. O. Box 15718, Gainesville, FL 32604 USA. 1999. ISBN 0-945417-95-0. To be ordered from the publisher.

An excellent revision of the speciose and morphologically diverse Neotropical nymphidiine riodinid genus *Theope* Doubleday, 1847, is presented. The taxonomic history of the genus, its morphological variation and characteristics, biogeography, early stage biology and adult ecology, particularly male perching behaviour, are discussed. Detailed notes are given for each species on identification and taxonomy, habitats and ecology, and distribution, and the localities listed and mapped for all examined specimens in the nearly twenty collections visited in Europe and in the Americas, as well as those recorded in the literature. A dichotomous key and colour illustrations of adults for all species are given, and drawings of the male abdominal and genitalic morphology for all but one species, and those of the female genitalia for the majority of species, are presented with a list of all dissections examined. Two genera are synonymised with *Theope* and five species are newly brought into combination with this genus. Further, two new species and two new subspecies are described. A number of taxonomic changes are also made at the species level and below, resulting in 68 species being recognised in the genus; 15 lectotypes are designated.

Alain Olivier

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Higgins, L. G. & Riley, N. D., 1980. A field guide to the butterflies of Britain and Europe. 4th ed. — Collins, London. 384 p., 63 pls.

Staudinger, O., 1901. Famil. Papilionidae - Hepialidae. *In*: Staudinger, O. & Rebel, H. Catalog der Lepidopteren des palaearctischen Faunengebietes. 3. Aufl. — Friedländer & Sohn, Berlin. XXX+411 p. (Tagfalter p. 1–97).

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Discovery of the types of *Polyommatus* (*Agrodiaetus*) *actis* and its taxonomic consequences (Lycaenidae)

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Summary. The nomenclatural and taxonomic history of the nominal taxon *Lycaena actis* Herrich-Schäffer, 1851 is outlined, and the taxonomic interpretations and quotations of the names *actis* Herrich-Schäffer, 1851, *atys* Gerhard, 1851 and *athis* Freyer, 1851 in the literature are reviewed. It thus appears that the three names apply to a taxon, which is treated as *Polyommatus* (*Agrodiaetus*) *firdussii* (Forster, 1956) pro parte by Hesselbarth *et al.* (1995) and subsequent authors. The discovery of two syntypes (♂, ♀) of *Lycaena actis* confirms this statement. The male specimen is designated as lectotype and the type locality corrected as Turkey, Tokat province, env. Tokat. The name *actis* is considered as the valid name for this taxon, thus promoting stability of nomenclature (cf. ICZN: Preamble, Arts. 23.2 and 23.9). Current taxonomic problems in part of the *actis* group are discussed. Under the name *actis*, probably more than one species is involved, but the picture is not quite clear. The intensity of the blue colour on the male upperside varies from vivid violet blue to a lighter blue, while the variation in colour does not always coincide with the pronounced differences in chromosome numbers and karyotype that are being observed (de Lesse, 1960, 1962; Lukhtanov *et al.*, 1998). A provisional arrangement is proposed for the nominal taxa *Polyommatus* (*Agrodiaetus*) *actis* (Herrich-Schäffer, 1851), *P.* (*A.*) *firdussii* (Forster, 1956), *P.* (*A.*) *pseudactis* (Forster, 1960), species incertae sedis, *P.* (*A.*) *sertavulensis* (Koçak, 1979), species incertae sedis, *P.* (*A.*) *ernesti* Eckweiler, 1989, species incertae sedis, *P.* (*A.*) *artvinensis* (Carbonell, 1997) and *P.* (*A.*) *sigberti* Olivier, van der Poorten, Puplesiene & De Prins, 2000 (= *P.* (*A.*) *actis* sensu Hesselbarth *et al.* (1995) and subsequent authors).

Zusammenfassung. Die nomenklatorische und taxonomische Geschichte des nominellen Taxons *Lycaena actis* Herrich-Schäffer, 1851 wird beschrieben, in Verbindung mit einer Literaturübersicht über taxonomische Interpretationen und Zitate der Namen *actis* Herrich-Schäffer, 1851, *atys* Gerhard, 1851 und *athis* Freyer, 1851. Alle drei Namen scheinen sich auf dasselbe Taxon zu beziehen, das von Hesselbarth *et al.* (1995) und nachfolgenden Autoren pro parte als zu *Polyommatus* (*Agrodiaetus*) *firdussii* (Forster, 1956) gehörig aufgefaßt wurde. Die Entdeckung zweier Syntypen (♂, ♀) von *Lycaena actis* bestätigt diese Einschätzung. Das männliche Exemplar wird hier als Lectotypus designiert und seine Typuslokalität korrigiert (Türkei, Provinz Tokat, Umgebung von Tokat). Der Name *actis* wird im Sinne der Stabilität der Nomenklatur (ICZN: Präambel, Art. 23.2 und

23.9) als valider Name des betreffenden Taxons angesehen. Gegenwärtige taxonomische Probleme in der Gruppe um *actis* werden diskutiert. Unter dem Namen *actis* im Sinne der vorliegenden Arbeit verbergen sich möglicherweise mehrere Arten, aber das gegenwärtige Bild ist noch unklar. Die Intensität der blauen Flügeloberseitenfärbung der Männchen variiert von lebhaftem Violettblau zu hellerem Blau, Unterschiede in der Flügelfärbung fallen nicht immer mit den beachtlichen Unterschieden in Chromosomenzahlen und Karyotypen zusammen (de Lesse, 1960, 1962; Lukhtanov *et al.*, 1998). Für die nominellen Taxa *Polyommatus* (*Agrodiaetus*) *actis* (Herrich-Schäffer, 1851), *P.* (*A.*) *firdussii* (Forster, 1956), *P.* (*A.*) *pseudactis* (Forster, 1960), species incertae sedis, *P.* (*A.*) *sertavulensis* (Kocak, 1979), species incertae sedis, *P.* (*A.*) *ernesti* Eckweiler, 1989, species incertae sedis, *P.* (*A.*) *artvinensis* (Carbonell, 1997) und *P.* (*A.*) *sigberti* Olivier, van der Poorten, Puplesiene & De Prins, 2000 (= *P.* (*A.*) *actis* sensu Hesselbarth *et al.* (1995) und nachfolgender Autoren) wird eine vorläufige systematische Anordnung vorgeschlagen.

Résumé. L'histoire de la nomenclature et de la taxinomie du taxon nominal *Lycaena actis* Herrich-Schäffer, 1851 est esquissée, ainsi que celle des diverses mentions et interprétations des noms *actis* Herrich-Schäffer, 1851, *atys* Gerhard, 1851 et *athis* Freyer, 1851 dans la littérature. Il apparaît ainsi que ces trois noms s'appliquent à un taxon, qui est traité comme étant *Polyommatus* (*Agrodiaetus*) *firdussii* (Forster, 1956) pro parte par Hesselbarth *et al.* (1995) et les auteurs plus récents. La découverte de deux syntypes (♂, ♀) de *Lycaena actis* confirme ce point de vue. Le spécimen mâle est désigné comme lectotype est la localité type est corrigée comme étant Turquie, province de Tokat, env. de Tokat. Le nom *actis* est considéré comme étant le nom valide pour ce taxon, promouvant ainsi la stabilité de la nomenclature (Code International de Nomenclature Zoologique: Préambule, Arts. 23.2 et 23.9). Les problèmes taxinomiques actuels relatifs à une partie du groupe d'*actis* sont discutés. Probablement, plus d'une espèce est comprise sous le nom *actis*, mais la situation est peu claire. L'intensité de la couleur bleue à la face supérieure du mâle varie d'un bleu-violet intense à un bleu plus clair, tandis que la variation du teint ne coincide pas toujours avec les différences importantes du nombre de chromosomes et du karyotype qui peuvent être observées (de Lesse, 1960, 1962; Lukhtanov *et al.*, 1998). Une classification provisoire est proposée pour les taxons nominaux *Polyommatus* (*Agrodiaetus*) *actis* (Herrich-Schäffer, 1851), *P.* (*A.*) *firdussii* (Forster, 1956), *P.* (*A.*) *pseudactis* (Forster, 1960), species incertae sedis, *P.* (*A.*) *sertavulensis* (Koçak, 1979), species incertae sedis, *P.* (*A.*) *ernesti* Eckweiler, 1989, species incertae sedis, *P.* (*A.*) *artvinensis* (Carbonell, 1997) et *P.* (*A.*) *sigberti* Olivier, van der Poorten, Puplesiene & De Prins, 2000 (= *P.* (*A.*) *actis* sensu Hesselbarth *et al.* (1995) et auteurs suivants).

Key words: Lycaenidae, *Polyommatus* (*Agrodiaetus*), *actis*, *atys*, *athis*, *firdussii*, *pseudactis*, *artvinensis*, *sertavulensis*, *ernesti*, taxonomy, nomenclature, lectotype, chromosome number, karyotype, Turkey, Iran, Armenia.

Introduction

The nomenclatural and taxonomic history of the nominal taxon *Polyommatus* (*Agrodiaetus*) *actis* (Herrich-Schäffer, 1851) is a

complicated one. In the sixth volume of his "Systematische Bearbeitung der Schmetterlinge von Europa, zugleich als Text, Revision und Supplement zu Jakob Hübner's Sammlung europäischer Schmetterlinge" (Nachtrag zum Ersten Bande, Heft 48, p. 24), Herrich-Schäffer ([1851]) gives the following short description: "*Actis* Kad. – **Sppl.** 496–499. Kleiner wie *Alexis*; dasselbe Blau, Vorderflügel stumpfer, die Unterseite so grau wie bei *Donzelii*, die Augen sehr scharf. – Aus Kleinasien." and, in Heft 49, in his first volume on plate 104, Figs 496–499 (also [1851]), depicts respectively one ♂ on the upperside and in resting position on the underside, and one ♀ in the same positions, again as "*Actis*" (Fig. 1 of the present study). Subsequently, in the "Systema Lepidopterorum Europae. Systematisches Verzeichniss der Europäischen Schmetterlinge", published in the sixth volume of his "Systematische Bearbeitung", he lists on p. 4 (Heft 55, [1852]): "23. *Lycaena*. ... 235. *Actis*.", while in the Index of his first volume (Heft 65, p. [1] – [1854]), he mentions "*actis* (*Lycaena*) Kad. pp 113 [sic! on that page in Vol. 1, *Acis* is quoted as synonym of [*Lycaena*] *Argiolus* L.] HS. 466–499. *Athis* Fr. [the latter name thus being quoted as a synonym]". Finally, in Vol. 6, on p. 172 (Heft 69 – 1856) he writes: "*Actis* dazu *Atys* Gerh. 19.3. a–d.", thus also considering the latter name as a synonym of the former. In all, very little information is contained in all data communicated by Herrich-Schäffer. Carl Gotthelf Kaden (1786–1867) apparently named this butterfly in litteris and communicated it as such to Herrich-Schäffer. The obituary published by Staudinger (1868) gives no evidence that Kaden ever travelled to Asia Minor, or perhaps even abroad, hence he must have obtained his material from that country through exchange or – much more probably – purchase. The figures of *actis* given by Herrich-Schäffer show a rather robust butterfly, of which the male wing upperside is blue with a very narrow black marginal line and black underlining of the veins in their distal fourth, but without any trace of black suffusion in the distal half of the hindwings. The dating of the various instalments ("Hefte") referred to above follows Hemming (1937) and is given on the wrapper to each Heft. Unfortunately, a survey of contemporaneous literature did not allow the present author to date those instalments more precisely, i.e. as to the month of publication, hence they all should be dated 31.XII. of the year concerned (ICZN, Art. 21.3.2).

Gerhard ([1851]) describes on p. 11 (Heft 5 – 31.V.1851, cf. Olivier, 1999) a blue as follows: "[*Lycaena*] ***Atys.*** Kind. Türkei. *Actis*. Herr.-Schaeff. Platte 19. Fig. 3. a, b, ♂, c, d, ♀. Diese von Herrn Kindermann entdeckte seltene Art nannte Herr Dr. Herrich-Schaeffer in Regensburg "*Actis*", da der Name *Atys* schon unter den Exoten sich befindet." The quality of the figures on plate 19 is not very good, but one can again discern a butterfly with a very narrow black marginal line, and absolutely no traces of black dusting in the apical area of the hindwings (Fig. 2 of the present study). His referring to Herrich-Schäffer could be interpreted as indirect evidence for Herrich-Schäffer's name being published before his own *atys*, but this is not necessarily so. The name *actis* may have circulated on sales lists or may have become known to Gerhard via Lederer, before Herrich-Schäffer actually published it, as is established for the names *asabinus* and *ochimus* (Olivier, 1999: 129). The most interesting information contained is perhaps, that both Herrich-Schäffer's *actis* and Gerhard's *atys* were named after material collected by Albert Kindermann Jr.

Finally, Freyer (1851), in his sixth volume (Heft 96), describes on p. 147 "*Lycaena* Pap.[ilio] *Athis*" as follows: "Der Mann von dieser *Lycaena* gleicht auf der Oberseite gewöhnlich dem *P. Alexis*." He further writes (pp. 147–148): "Eine sehr schöne Abart desselben, die dunkler Blau und von der Außenseite gegen die Flügelmitte, in eine schwarze Mischung auf der Oberseite verläuft, zeigt meine Fig. 2. [Fig. 3 of the present study]. Man könnte diese Abart wohl für verschieden vom gewöhnlichen Manne halten, wenn erwiesen wäre, daß solche öfters vorkömmt, worüber mir Herr Kindermann keine Nachrichten ertheilt hat. Das Weibchen ist auf der Oberseite einfach braun wie das von *P. Acis*, Die Unterseite hat ♂ und ♀ ganz übereinstimmend mit *P. Damon*, so daß sich beide Arten von solchem nur durch die geringere Größe unterscheiden. Es zeigen sich wie bei *Damon*, auf den Vorderflügeln das schwarze Mittelauge und die aus großen Augen bestehende weiß eingefaßte Augenbinde, und die Hinterflügel führen die kleine Augenreihe mit den weißen Splitterstrich durch die Flügelmitte vom Wurzelfelde aus. Fühler wie bei den vorhergehenden Arten. Heimath: Amasia.". Beside the interesting information that the type locality of *athis* is Amasia and that Kindermann again is the pro-

Fig. 1. Plate 104 from G. A. W. Herrich-Schäffer's "Systematische Bearbeitung der Schmetterlinge von Europa, zugleich als Text, Revision und Supplement zu Jakob Hübner's Sammlung europäischer Schmetterlinge", Vol. 1, Heft 49 [31.XII.1851].

Fig. 2. Plate 19 from P. B. Gerhard's "Versuch einer Monographie der europäischen Schmetterlingsarten: *Thecla*, *Polyomattus* [sic], *Lycaena*, *Nemeobius*. Als Beitrag zur Schmetterlingskunde", Heft 5 [31.V.1851].

vider of the material, the description consists of two parts: first, the 'nominotypical' taxon looks on the upperside like "*P. alexis*" (a junior primary homonym of *Papilio alexis* Poda, 1761 [currently *Glaucopsyche alexis* (Poda, 1761)] and a senior subjective synonym of *Papilio icarus* Rottemburg, 1775 [currently *Polyommatus icarus* (Rottemburg, 1775)]) and hence again as a blue with a very narrow black marginal line; second, an "Abart" [to be interpreted as form rather than as geographical race or, in present-day terminology, subspecies] is described but not named (!), the ♂ of which has a darker blue wing upperside with extensive black dusting of the apical area, thus suggesting that a distinct taxon is actually involved. It is the latter form that is figured by Freyer. The dating of Heft 96 was established from the printed date on the wrapper (Tremewan, 1988), while a search through contemporaneous literature could not reveal more precise data (Olivier, *in press*).

At this stage, it is worthwile to report on the travelling activities of Albert Kindermann Jr. near Amasia, in order to establish the precise origin of the material that served to describe *actis*, *atys* and *athis*. In March 1848, Kindermann left Ofen [Budapest], along with Stefan Nogell, for a planned journey to Russia (Nogell would collect in 'Grusien', i.e. Georgia), but the Russian authorities refused to let him go there and so they were forced to travel to Anatolia. They arrived in Samsun on 3rd May and stayed there for three weeks. As the vegetation was not well out yet and as very few butterflies were on the wing, Nogell decided to move to Amasia, where Kindermann joined him at the beginning of July. From here, Kindermann explored snowy mountain ranges at six hours walk to the north of town, at altitudes up to 6,000 feet (2,000 m), where he collected very well, but to the end of the year he travelled through Triest back to Ofen. In 1849 he went back to Amasia, this time collecting near Tokat, that is surrounded by even higher mountains, but added only few new species. He returned back again in autumn, sending his material to his colleagues when in Ofen. In May 1850 he collected near Diabekir (now Diarbakir), in June near Sivas and in July near Tokat. His assistant (Nogell) concentrated his activities in the mountains near Tokat in 1848 and 1849 and returned back to Ofen only in September of the latter year (Lederer, 1855; [Lederer], 1860; Staudinger, 1878). In his "Verzeichniss der von Herrn Albert

Kindermann 1848–1850 um Samsun, Amasia, Tokat, Siwas und Diarbekir gesammelten Schmetterlinge" (pp. 235–254), Lederer (1855: 237) lists "[*Lycaena*] *Actis* H.-Sch. ... Auf den Tokateralpen". It is quite possible, however, that Kindermann also collected material elsewhere, as Staudinger (1878: 181) quotes: "Auch konnte Lederer nicht alle von Kindermann gefundene Arten aufführen, da derselbe, wenigstens an Gruner bestimmt, direkte Sendungen machte die Arten enthielten, welche er an Lederer nicht sandte". In the systematic part of his publication however, Staudinger (*loc. cit.*: 254–255) reports that it was found by Kindermann "in den Tokat-Alpen". He further mentions: "Drei alte ♂♂ (aus Lederer's, Weissenborn's und Sommer's Sammlung), welche ziemlich sicher von Kindermann bei Tokat gefangen wurden, sind auf den Hinterflügeln mehr schwarz als blau". Interestingly, Staudinger (1899: 147) explicitely states: "Freyer giebt zwar Amasia als Fundort seiner *Athis* an, aber fast zweifellos stammt sein ♂ von Tokat, da weder ich, noch irgend ein anderer Sammler (soweit mir bekannt) *L. Athis* bei Amasia fand". It thus appears that both "forms", i.e. "typical *actis*" and the "Aberration ... Abart" with blackish suffusion in the distal part of the hindwings, originate from the surroundings of Tokat, rather than from Amasia.

Taxonomic interpretations and quotations of the names *actis*, *athis* and *atys* in literature

Heydenreich (1851: 13) was not yet in the possession of the critical instalments of Gerhard, Herrich-Schäffer and Freyer when writing his catalogue (cf. Olivier, 1999, *in press* and *in prep.*) and published under nr. 337 the name "[*Lycaena*] *Atys* Kind. i. l.", which is a nomen nudum, as it is not accompanied by any description or reference to another work. Keferstein (1851: 305) only had Gerhard up to Heft 5 and hence quoted under nr. 183 "[*Lycaena*] *Damon* Var. d *Atys* Gerhard tab. 19. f. 3. Amasia" and apparently the same applies to Meyer-Dür (1852: 94) who also listed the name "[*Lycaena*] *Atys* Kinderm." among the "Varietäten" of "*Lycaena Damon* O.".

Fig. 3. Plate 573 from C. F. Freyer's "Neuere Beiträge zur Schmetterlingskunde mit Abbildungen nach der Natur", Vol. 6, Heft 96 [31.XII.1851].

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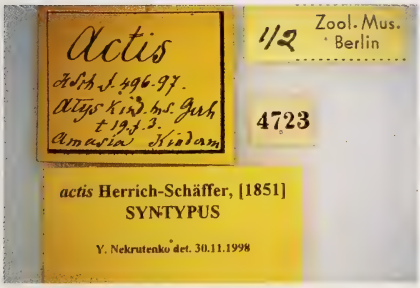

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Fig. 4. *Polyommatus* (*Agrodiaetus*) *actis* (Herrich-Schäffer, 1851), lectotype ♂ (upperside), [Turkey, Tokat province], "Amasia" [recte Tokat], [VII.1849], leg. Albert Kindermann, in coll. Museum für Naturkunde der Humboldt-Universität zu Berlin.
Fig. 5. Same as Fig. 4 (underside).
Fig. 6. Same as Fig. 4 (labels, the one containing the lectotype designation not included).
Fig. 7. *Polyommatus* (*Agrodiaetus*) *actis* (Herrich-Schäffer, 1851), paralectotype ♀ (upperside), [Turkey, Tokat province], ["Amasia", recte Tokat], [VII.1849], [leg. Albert Kindermann], in coll. Museum für Naturkunde der Humboldt-Universität zu Berlin.
Fig. 8. Same as Fig. 7 (underside).
Fig. 9. Same as Fig. 7 (label, the one containing the lectotype designation not included).

Lederer (1852: 21) quotes "*Actis* H.-Sch. 496–499", with "*Athis* Freyer 575" as synonym, while later (Lederer, 1869: 81–82) he considers *actis* as only a variety of *damon*. It is clear that, for him, typical *actis* is violet blue and "der schwarze Rand fehlt (*Actis* H. Sch.)", while he further also mentions "unter *Actis* eine Varietät mit fast ganz schwarzen Hinterflügeln". He further reports *actis* from Astrabad (now Iran, province of Māzandarān, Gorgān), the Taurus Mts. (own observations), as well as from Achalzich (now Georgia, Akhaltsikhe), Hankynda (now Nagorno-Karabach (disputed: Armenia vs. Azerbaijan), Xankändi; known also as Stepanakert) and several mountainous areas of Transcaucasia (leg. Haberhauer; see also Lederer, 1870: 23).

In the first edition of his catalogue, Staudinger (1861: 6), under nr. 149, writes: "[*Lycaena*] ***Actis*** HS. 496–9. (1851); *Athis* Frr. 537, 2. 3. (Febr. 1852); *Atys* Gerh. T. 19, 3 a–d.", thus also considering *actis* as the valid name for this taxon. In the second edition of his "Catalog", Staudinger (1871: 13) considers *actis* again as a "varietas" *of L. damon*, stating under entry 172g: "v. *Actis* HS. 496–9 (1851), VI p. 24; Ld. Hor. l. c. *Athis* Frr. 573, 2. 3 (Febr. 1858); *Athys* Gerh. Pl. 19, 3a–d; ? *Iphigenia* Gerh. 20. 2 (minor, violaceo-caerul., ♂ interdum nigricans)" and reporting it from "*As.min; Arm. et Hyrc.; Mont. et Alp.*". Staudinger (1878: 251) lists "[*Lycaena*] *Actis* HS.; Ld.; *Athis* Frr.; *Athys* Gerh. *Carmon* Ld. pro parte. — Pont. alp. (Tokat); Lyd. m. alp.; *var.*: Hyrc. et Arm.". It is clear that, for Staudinger (*loc.cit.*: 254–255) as well, typical *actis* "hat … einen weit schmäleren schwarzen Aussenrand der Flügel". He further notices that "Die *Actis* aus Armenien und Nord-Persien sind nicht so tiefblau wie die kleinasiatischen, indessen sind sie doch stets rein blau, etwa wie bei *Icarus*, nie so grünblau wie *Iphigenia*, haben auch einen schmalen schwarzen Randsaum, wie die typischen *Actis*" and, finally, apparently considers *actis* as being a distinct species again. Staudinger (1886: 214–215) describes the nominal taxon "*Lyc.*[*aena*] *Actis* var. *Actinides* Stgr. … aus dem südlichen Alai [now Tajikistan: Transalai Mts.]". Staudinger (1899: 146–147) repeats by and large what he said in 1878, adding "aus verschiedenen Orten des Taurus, aus Malatia (westliches Kurdistan) und von Gümüschane (nordöstliches Pontus-Gebiet)" to the known localities, but now applies the name

Athis to the "form" with extensive black suffusion: "Dahingegen scheinen die von Kindermann bei Tokat gefangenen *Actis* ♂♂ durch *stärkeres Auftreten* von *Schwarz* besonders auf den Hinterflügeln (wo es bei 2 meiner 3 ♂♂ das Blau fast ganz verdrängt hat), vielleicht vorwiegend verschieden gewesen zu sein, so dass sie in diesem Falle als Lokalform, jedenfalls aber als auffallende Aberration, den Namen ***Athis*** Freyer (unter welchem Freyer, Taf. 573 Fig. 2, ein solches ♂ abbildet) führen können". He further elevates *actinides* to species rank, which is currently still the taxonomic status of this butterfly. Staudinger & Rebel (1901: 88, nr. 626) list "[*Lycaena*] ***Actis*** HS. 496–9 (1851) VI p. 24; Ld. Hor. VI p. 81; Stgr. Hor. XIV p. 254; Iris XII p. 146; *Athys* Gerh. t. 19, f. 3 a–d." from "*Pont; Arm; Hyrc; Kurd. oc; Taur.*" and, as a separate entry, "a) v. (an ab?) *Athis* Frr. 573, 2 ♂ (3 ♀) (♂ plus minusve praesertim in al. post. nigro-mixtus)" from "*Pont. (Tokat); As. min. c. (Konia)*".

Bienert ([1869]: 46) lists "*Lycaena Actis*" from Amasia and Tokat, while Kirby (1871: 370) writes: "237. c. **C. Actis, Herr. Schäff**. (*Lyc. A.*) Schmett. Enr. (sic!) I. f. 496–499. (1851); Led. Hor. Soc. Ent. Ross. VI. p. 81 (1869); *Lyc. Athis, Frey*. Neuere Beitz [sic!]. VI. t. 537. f. 2, 3. (1852); *Lyc. Damon, var. Atys, Gerh.* Mon. Lyc. t. 19. f. 3 a–d. (1853). ib. Asia Minor." Christoph (1873: 26) mentions "*Lycaena Damon* ... var. *Actis* HS." as "Nicht eben selten bei Hadschyabad [now Iran, province of Māzandarān, Hajibad] und Schahkuh [now Iran, province of Māzandarān, Shāhkūh]". Romanoff (1879: 487) reports *Lycaena Damon* Schiff. v. *Actis* HS. from the "Haut-Plateau Arménien": "Très abondante sur le mont Ben-gel et Zchniss-Kala" (now in southwestern Armenia and northeastern Turkey), while Bramson (1890: 42), in his key to the genus *Lycaena*, lists among the characters of "***Actis*** H. S.": "Der dunkle Saum der Obs. sehr schmal, Rippen am Saume nicht schwarz. ♂ oben tief hochblau, bisweilen schwärzlich bestäubt, besonders auf den Htfl.", thus suggesting that he also considers typical *actis* to lack any extension of black suffusion. He further lists as synonyms: "Syn. *Athis* Frr. *Athys* Gerh. *Carmon* Ld. pro parte. *Damon var.* (Stgr. Cat. 1871 No. 172 g)" and gives as range: "Oestlicher Caucasus, Transcaucasien". Groum-Grshimaïlo (1890: 409–412), dealing with "*Lycaena Actis* HS. var. *Actinides*

Stgr.", states a. o. (p. 411): "les ♂♂ sont d'une coloration plus lilas que p. ex. les *Actis* de Kasikoparan, moins brillants et à bordure noire plus large", thus also treating the latter taxon as one lacking any black suffusion on the male wing upperside. Rühl (1893: 290) writes: "***L. Actis* H. S.,** *Athis Frr.*, *Athys Gerh.* Wenig kleiner (Exemplare eben so gross wie *Kindermanni* kommen jedoch vor). Vorderflügel und Hinterflügel mit verändertem, in's Violette ziehenden Blau, Schatten am Aussenrand schmäler und schwächer, Rippen nicht schwarz einmündend. ♂ sehr selten schwärzlich, besonders an den Hinterflügeln bestäubt, ... Fluggebiet: in Transkaukasien, bei Hadschyabad und Schahkuh (Persien). Heyne (1895: 765) adds: "S. 290. ***L. Actis* H. S.** Weitere Fundorte: Oestlicher Kaukasus, Kleinasien, Armenien". It is thus clear that, for Rühl also, typical *actis* is the blue with a very narrow black marginal line. Holtz (1897: 47) writes about "*L. actis* H.-S.": "Von Lederer und Haberhauer an denselben Örtlichkeiten gefangen wie die vorige Art ["In höheren Teilen des Taurus von Lederer und Haberhauer gefunden"]". Radde (1899: 420), in his list of the Lepidoptera collection housed in the Museum Caucasicum (which is virtually a part of Romanoff's collection), states "[*Lycaena*] *actis* H. S. Kasik[o]p.[oran]".

In a faunistical paper on the butterflies of Crimea, Melioransky (1897: 220) lists "*Lycaena actis* H. S. — a single specimen collected in July 1893" — but without doubt he misidentified a different species (cf. Forster, 1960: 107; Nekrutenko, 1985: 139). The report of "*Lycaena damon* var. *actis* H.-S." from the Rilo Dagh in Bulgaria by Bachmetjew (1902: 404) is also based on a misinterpretation (Forster, *loc.cit.*: 107, footnote).

Seitz (1909: 318) lists "***L. actis*** *H.-Schäff.* (= *athys Gerh.*) (82a).", also considering the totally blue butterfly as typical, while "Bei der Form ***athis*** *Frr.* (82a) ist der Rand der Vflgl und die ganze Aussenhälfte der Hflgl von der blauen Bestäubung freigelassen und erscheinen tiefschwarz". Courvoisier (1910: 192) mentions "*Actis* H. S. mit Var. *Athis* Frr." as a distinct species, while Courvoisier (1914: 152) lists *actis* H Sch., with "*atys* (Kindermann) Ghd. 1853" as a synonym and "*athis* Freyer" as a "Nebenform". Le Cerf (1913: 69) merely lists "*L. actis* H.-Sch." in his account on the butterflies of Persia.

Wagner (1929: 62) reports "*Lycaena actis* H. S. und var. *athis* Frr." from the Sultan Dagh (now Sultan Dağları, in the provinces of Afyon, Isparta and Konya) north of Akşehir, in the western Taurus. Osthelder & Pfeiffer (1932: 48) list "[*Lycaena*] *actis* H. Sch. ssp." in their account of the butterflies from Marash, also quoting in their brief description of the butterfly: "Das wunderbare Blau besonders leuchtend und ohne jede Saumlinie". Schwingenschuss (1935: 132) publishes a report of butterflies collected in the neighbourhood of Bolu (June) and in Akşehir and on the nearby Sultan Dağları (July). From the latter area, he reports "*Lycaena athis* Frr." and "*athis* nov. ab. *lunulata* Schw.". As the name refers to an infrasubspecific form, it is unavailable, the more it is not accompanied by any description. Subsequently, Schwingenschuss (1938: 146) quotes "*Lycaena actis* H. S. ssp. *athis* Frr.", thus for the first time unambiguously using this name at subspecies level, and applying it to the taxon with blackish apical suffusion, as he further writes: "Kommt nur in der ssp. *athis* mit der ganzen Variationsbreite vor (Pf). Ich habe auch nur *athis* gefunden, darunter Stücke mit prächtig blauen Monden auf den Hinterflügeln, für die ich den Namen *lunulata* in Vorschlag brachte (Verh. d. z. b. G. 1935, S. 132) (Sch)". His name *lunulata* does not become available by this action, as it stays infrasubspecific. Schwingenschuss (1939: 88) lists "*L. actis* H. S." from the central Elburs Mts. in northern Iran, reporting it "Im Tarseegebiet (Pf., Sch., W.) und bei Pelur (Sch.) in ganz wenigen, meist schlechten ♂♂ erbeutet", thus also considering the name *actis* to apply to a blue without any black suffusion on the upperside.

Forster (1936: 59; 1938: 116) merely lists "*actis* H.-Sch." but, in his famous "Bausteine", for the first time since Staudinger (1899), deals with the subgenus *Agrodiaetus* in detail, undertaking a series of taxonomic actions which are of great importance for a further understanding of this story. Under "*Agrodiaetus damone* Ev.", Forster (1956: 58–59, Tafs 8–9, Figs 16–17) describes the nominal taxon "*A. damone firdussii* ssp. nov." from Shāhkūh in the eastern Elburs (northern Iran), listing in its synonymy "*actis* pro parte Staudinger, Horae Soc. Ent. Ross. 14, 1878, p. 255" and "*actis* Schwingenschuss, Entom. Zeitschr. 53, 1939, p. 87". Later, Forster (1960: 106–107, Tafs. 10–11, Figs 1–3) deals with "*A. actis actis*

H. Sch.", listing "*athys* Gerhard", "*damon* var." sensu Staudinger (1871: 13) and both "f. *athis* Freyer" and "f. *lunulata* Schw." among its synonyms. He considers his ♂ material to consist of 20 *actis* and 70 *athis*, the latter being a mutation that is a little smaller, a deeper violet blue and, especially on the hindwing, has an extensive black suffusion, and believes that "Ende des 19. Jahrhunderts war die f. *athis* Frr. offensichtlich noch wesentlich seltener, wie aus der Literatur und dem untersuchten alten Material zu entnehmen ist". As type locality ("Loc. class.") he mentions "Kleinasien". He further describes "*A. actis pseudactis* ssp. nov." (Forster, *loc.cit.*: 107–109, Tafs 10–11, Figs 4–5) from Armenia, that is a more bright blue, including among its paratypes material originating from localities now in the northeast of Turkey, i.e. in the Aras Valley (Kagysman, Kulp, Kazikoparan, Agri Dagh, Geliagadzha (now resp. Kağızman, Iğdır, Kazıkoparan, mountains south of Kazıkoparan, untraceable locality near Kağızman, in the provinces of Kars and Iğdır)), as well as material collected by de Lesse in 1956 ("Col du Kop Dagh entre Bayburt et Erzerum" (Kopdağı Geçidi, at the border of the provinces of Bayburt and Erzurum), "Mirgemir Dagh entre Erzurum et Agri" (Tahir Geçidi, province of Ağrı), "Col routier entre Erzerum et Agri"), and further 1♂, 1♀ from Ordubad (now in Naxçivan). Interestingly, Forster (*loc.cit.*: 109) further lists material from the Elburs, "Mesopotamia", "Kurdistan" (incl. vic. Malatya), "Zeitun" (now Süleymanlı in the province of Maraş) and the Taurus (both Lydia and the Cilician Taurus!) as belonging only conditionally to *pseudactis*, and possibly representing an undescribed subspecies. It is worth mentioning, that Wiltshire (1957: 30) reports "*Polyommatus actis* H.-S. ssp. *pseudactis* Forst." from Iraq "At great heights in the mountains", three years before Forster's description! As no definition of the taxon is given, Wiltshire's name is a nomen nudum.

In the late 1950's and early 1960's, de Lesse carried out extensive karyological studies on *Agrodiaetus* taxa from Turkey and Iran, his results still forming the basis of much of our current views on taxonomy in this difficult group. In his thesis, de Lesse (1960: 186–187), on karyological evidence, transfers the nominal taxon *firdussii* to the rank of subspecies of "*Agrodiaetus actis*": from his

discussion, it further appears that, for him, *actis* is also a blue without any black suffusion in the apical part of the wings. On his table on p. 207, and on fig. 219 on the next page, he lists "*A. actis pseudactis* Forst. *in litt.*" from "Mirgemir D." and "Kop Dagh" and "*A. actis firdussi* Forst." from the Demavend (Elburs Mts.). In a separate paper, de Lesse (1962) presents new data on the chromosomal variation in "*Agrodiaetus actis*", including results for one population from Bürücek in the Taurus Mts. (province of İçel, Tekir) that, according to him (p. 67), may belong to a new subspecies, "ainsi que l'a récemment indiqué Forster". This population is likely to belong to the newly described *P.* (*A.*) *sigberti* Olivier, van der Poorten, Puplesiene & De Prins, 2000 (cf. Oliver *et al.*, 2000).

Higgins (1966: 213), in his checklist of Turkish butterflies, lists under nr. 118: "*Agrodiaetus actis* Staudinger. "Taurus"; 28 as *lunulata* Schwingenschuss; 43 as *athis* Freyer (42)". His publication being based on a survey of the literature, one cannot tell which butterfly Higgins considers to be *actis*. Goossens & Cromphout (1978) and Goossens (1979), in two accounts on successive collecting trips in Turkey, include "*Agrodiaetus actis* Staudinger" from the province of İçel in a list of butterfly taxa, following the concept of Higins's (1966) paper. Again, one cannot tell what they understand under *actis*.

Koçak (1979: 323–324) describes "*Agrodiaetus* (s. str.) *pseudactis sertavulensis* n. subsp." from the Sertavul Geçidi in the province of Konya in Turkey, placing it in the "*actis-pseudactis* group" but rather closer to *pseudactis*, according to wing shape and coloration. He further considers that the ranges of both *actis* and *pseudactis* overlap partly in the Taurus Mts. and consequently proposes *pseudactis* to be a distinct species from *actis*. Subsequently, Koçak (1980: 19), as a result of a study on the publication dates of Gerhard's "Versuch einer Monographie der europäischen Schmetterlingsarten ... (1850–1853)", concludes that [*Lycaena*] *actis* Herrich-Schäffer, [1851] (December) is a synonym of *Lycaena atys* Gerhard, [1851] (May). In his "Critical check-list of European Papilionoidea", Koçak (1983: 33) lists "[*Agrodiaetus*] *atys* Gerhard, 1851" (with *actis* Herrich-Schäffer, 1852 as synonym) and "[*Agrodiaetus*] *pseuactis* Forster, 1960" [sic!], quite in agreement with the conclusions arrived at in his two previous papers.

Eckweiler & Hofmann (1980: 20) list two subspecies of "*Agrodiaetus actis* Herrich-Schäffer, 1851" in their "Checklist of Iranian butterflies", i. e. ssp. *pseudactis* Forster, 1960 (provinces of [West- and East-] Azerbeijan) and ssp. *firdussii* Forster, 1960 (Elburs), while Eckweiler & Görgner (1981: 105) report "*Agrodiaetus actis* Herrich-Schäffer, 1851 ssp. *pseudactis* Forster, 1960" from the Palandöken Mts. in the province of Erzurum, in northeastern Turkey. In an important taxonomic paper, Eckweiler (1989: 97) considers, in full agreement with Koçak (1979), that *pseudactis* and *actis* are distinct species as, according to him, both appear to be syntopic and synchronous in the Taurus range. Eckweiler (pers. comm. 29.IV.2000) applied the name *actis* to the taxon we now know as *P.* (*A.*) *sigberti*. He further underlines the conspecificity of *firdussii* Forster, 1956 and *pseudactis* Forster, 1960 and establishes the following new combinations: *Polyommatus* (*Agrodiaetus*) *firdussii firdussii* (Forster, 1956) (Elburs), *P.* (*A.*) *firdussii pseudactis* (Forster, 1960) (East Anatolia) and *P.* (*A.*) *firdussii sertavulensis* (Koçak, 1979) (Taurus). He describes a new taxon, "*Polyommatus* (*Agrodiaetus*) *firdussii ernesti* subspec. nov.", from near Elmalı in the Kohu Dağları in the Turkish province of Antalya, in the western Taurus, while admitting that specimens transitional to *sertavulensis* (according to underside markings) occur on the Palaz Dağı, in the eastern part of the province of Antalya. He finally figures (Abb. 43–46) "*Polyommatus firdussii* trans. ad *sertavulensis* Koçak" from the Turkish province of Niğde (Çamardı, Çukurbağ).

De Prins *et al.* (1991: 146 and plates 1 & 2, figs 11 & 14) list material from the province of Van, in southeastern Turkey, as "*Polyommatus* (*Agrodiaetus*) *firdussii* (Forster, 1956)" and so do Koçak & Seven (1994: 6, as "*Agrodiaetus firdusii* Forst." [sic!]), while Avcı & Özbek (1996: 84) also name "*Polyommatus firdussii* Forster, 1956" material from the province of Erzurum. Seven (1996: 28–29) reports this taxon among material collected "in Central and North Turkey". Lukhtanov *et al.* (1998) ascribe material from different localities in the southeastern Turkish provinces of Bitlis and Van to "*P.* (*A.*) *firdussii pseudactis* (Forster, 1960)".

In their monumental work on the butterflies of Turkey, Hesselbarth *et al.* (1995) apply the species group name *actis*

Herrich-Schäffer to the smaller species, the ♂ of which is more violet blue, often with a more or less extensive blackish suffusion in the distal half of the hindwing (cf. Tafel 123, Figs 1–21), that had been ascribed to *athis* Freyer by several earlier authors, from the second half of the 19th century up to Forster (1960). In their interpretation, they consider both *atys* Gerhard and *athis* Freyer as subjective synonyms of *actis* Herrich-Schäffer and further give as chromosome number "*n* = 27, Bürücek (Içel) (de Lesse, 1962a: 68)". Their interpretation (and that of Eckweiler, vide supra) is quite understandable, when one knows of the arrangement of Forster's material in coll. Zoologische Staatssammlung München: under "*actis actis* H.S.", 46♂, 7♀ of *P.* (*A.*) *sigberti* (now labelled as paratypes) are included at present, while among "*actis pseudactis* Forst.", 1♂ of *P.* (*A.*) *actis* from "Kleinasien Amasia Korb" and 9♂ from various localities in the Taurus Mts. (all violet blue, quite different from *sertavulensis*) are included along with *P.* (*A.*) "*wagneri*" (Forster, 1956) from "Konia" (2♂) and "Lydia Cilicië Taurus". The larger species without any blackish suffusion is named *P.* (*A.*) *firdussii* (Forster, 1956) and *pseudactis* (Forster, 1960) is sunk in synonymy (cf. Tafel 122, figs 37–72). Nevertheless, the authors leave open the possibility that "*firdussii*" consists of more than one taxon on karyological evidence. *P.* (*A.*) *sertavulensis* (Koçak, 1979) is raised to species rank on morphological-chorological data, as on Sertavul Geçidi they found both species (*sertavulensis* and *wagneri* — not *firdussii*! — cf. locality lists on pp. 728–733) syntopic and synchronous; they further synonymize *ernesti* under *sertavulensis*.

Häuser & Eckweiler (1997) list alphabetically all the species group taxa dealt with so far in the present overview, with their original combination, type locality and data to their primary sources (literature reference as well as current depository of extant types (when existing), while Eckweiler & Häuser (1997), in a systematic checklist, arrange the species group taxa into different unnamed species groups. All taxa relevant to the present study are placed in a very inclusive, large "*A. damon* group", and the nominal taxa *actis* (sensu Hesselbarth *et al.*, 1995!), *firdussii* and *ernesti* are figured in colour. The names *ernesti*, *sertavulensis*, *pseudactis* — but also *maraschi* Forster, 1956 — are associated as subspecies to *firdussii*. The latter taxon was described by Forster (1956:

57–58) as a subspecies of "*A. damone*", but is currently considered to represent either a junior synonym or a subspecies of *P.* (*A.*) *wagneri* (Forster, 1956) (Hesselbarth *et al.*, 1995; Carbonell, 1998). In the Zoologische Staatssammlung München, I found 4♂ of *actis* from "Syr. sept. Taurus Marasch", that clearly differ from the holotype and 2♂ paratypes of *maraschi*, that were also collected in the same locality, in being darker violet blue, with the spots and the submarginal lunules on underside hindwing much more apparent. The holotypes of *wagneri* and *maraschi* are also very different and it thus appears to the present author that *maraschi* is a taxon quite distinct from both *actis* and topotypical *wagneri*.

Bálint & Johnson (1997: 19) list *actis* and *firdussii* without any further subdivision, while Bálint (1999: 31) lists 10 ♂, 2 ♀ paratypes of *firdussi* [sic], deposited in The Natural History Museum, London.

Carbonell (1997) presents an historical overview of the "complexe *actis-firdussii-pseudactis*", also applying the names *actis* and *firdussii* in the sense of Hesselbarth *et al.* (1995) and describes "*A. actis artvinensis* n. ssp." from the extreme northeast of Turkey (provinces of Erzurum and Artvin), that is characterized by the even darker violet blue colour with traces of a discoidal spot, as well as the extreme development of the black suffusion on both fore- and hindwings on the upperside, and by the dark grey-brown ground-colour with sharply contrasting white streak on the underside. He further states about the specimens of "*actis* ssp?" from Bürücek, of which de Lesse (1962) studied the karyotype: "la majeure partie des ♂♂ concernés ont effectivement les nervures noircies sur plusieurs mm, mais sans aucune trace de suffusion submarginale noire". Carbonell (1998) reports the sympatry of "*pseudactis*" and *sertavulensis* on the Sertavul Geçidi. He lists *pseudactis* as a subspecies of *firdussii* and, in accordance with Hesselbarth *et al.* (1995), considers *sertavulensis* as a distinct species, but *ernesti* as a valid subspecies of the latter. Carbonell & Naderi (2000: 219) again quote "*A. actis artvinensis* Carbonell, 1997" in the heading on the differential diagnosis of their new taxon *Agrodiaetus arasbani*. Reinhard & Eitschberger (1999: 350), following Häuser & Eckweiler (*loc.cit.*) and Eckweiler & Häuser (*loc.cit.*), present the same arrangement and further add *artvinensis* as a subspecies of *actis* (sensu Hesselbarth *et al.*, 1995).

Lately, Koçak (1996: 22–23) has listed "*Polyommatus* (*Agrodiaetus*) *atys*" and *P.* (*A.*) *firdussii* as two different species, the latter with four subspecies (*firdussii*, *pseudactis*, *sertavulensis* and *ernesti*). It is not stated however if Koçak (*loc.cit.*) and Koçak & Seven (1996) interpret "*atys*" as "*actis* sensu Hesselbarth *et al.* (1995)" or in a different way, but Koçak & Seven (1998) probably do, as they link *artvinensis* (Carbonell, 1997) as a subspecies to "*atys* (Gerhard, [1851])". They also list *maraschi* as a subspecies of *firdussii* (presumably following Eckweiler & Häuser, 1997).

Lectotype designation

After Herrich-Schäffer died in 1874, his private Lepidoptera collection was split up via Staudinger & Bang-Haas and part of it went via the private collection of Otto Staudinger to the Zoological Museum of Berlin [now Museum für Naturkunde der Humboldt-Universität zu Berlin]; many Lepidoptera described from the Kaden collection by Herrich-Schäffer became isolated in various collections (Horn *et al.*, 1990).

While visting the Museum für Naturkunde der Humboldt-Universität zu Berlin in late November 1998, I was shown a box by Dr. Yuri P. Nekrutenko, that included two apparent syntypes (♂, ♀) of [*Lycaena*] *Actis*. In their primary position in the collection, both specimens were placed behind a bottom label attached to the first specimen (♂); this specimen also bears a printed numerical label "4723" to refer it to the handwritten inventory book entitled *Catalogus Generalis Musei Zoologici Berolinensis*. Vol. 1 (Nos. 1–3753) Vol. 2 (Nos. 3754–10098), that is deposited in the Lepidoptera section library; each entry (row) of the Catalogus consists of five columns: number (shown on the printed label) | name and author | number of specimens | locality | collector or provider. In the "Catalogus", under "4723" is written: "Lycaena Actis HSch. | 2 | Amasia | Kindermann".

I herewith designate the ♂ as lectotype (Figs 4–6) and the ♀ as paralectotype (Figs 7–9):

Lectotype ♂ with labels: handwritten "Actis | HSch. f. 496-97| Atys Kind.[ermann] ms. Gerh.[ard] | t. 19. f. 3. | Amasia <recte

Tokat — vide supra> Kind[ermann]" (recto yellow, in printed box, verso white); printed "4723" (on white paper), "actis Herrich-Schäffer, [1851] | SYNTYPUS | Y. Nekrutenko det. 30.11.1998" (on yellow paper); designated now with printed label "[Lycaena] Actis | Herrich-Schäffer, 1851 | LECTOTYPUS ♂ | design. Olivier, 2000" (on red paper).

Paralectotype ♀ with printed labels "*actis* Herrich-Schäffer, [1851] | SYNTYPUS | Y. Nekrutenko det. 30.11.1998" (on yellow paper); designated now with printed label "[Lycaena] Actis | Herrich-Schäffer, 1851 | PARALECTOTYPUS ♀ | design. Olivier, 2000" (on red paper).

Type locality. Since label and stated type locality ("Amasia") are found to be erroneous (see *Introduction* above), it is corrected here according to the available data as *Turkey, Tokat province, env. Tokat* (ICZN, Art. 76.2, Recommendations 74E, 76A.2).

Taxonomic consequences

Nomenclature. Koçak (1980: 19) proposed "*Agrodiaetus atys* (Gerhard, [1851)" as the valid name for this species, as it was published in May 1851, thus taking precedence over [*Lycaena*] *actis* Herrich-Schäffer, [1851] (December), the latter name furthermore having been published uninominally. Except for Heydenreich (1851), Keferstein (1851) and Meyer-Dür (1852), who did not possess Hefte 48 and 49 of Herrich-Schäffer's work, all authors except Koçak, from the second half of the 19th century up to 1995, used the name *actis* for this taxon. Indeed, the name *actis* just looks like published without combination with a generic name, but it is obvious that Herrich-Schäffer consistently applied the Principle of Binominal Nomenclature and ascribed it to the genus *Lycaena*, likewise all the "blues" in volume 1 of his work are placed in this genus (ICZN Art. 11.4). It is therefore agreed here with Hesselbarth *et al.* (1995: 732) that the name *actis* should be considered as the valid name for this taxon, thus promoting stability of nomenclature (see also ICZN, Preamble and Arts. 23.2 and 23.9). The more, there is now also a lectotype available for *actis*, while Gerhard's collection (including the type specimens of *atys*) was probably entirely destroyed (Olivier, 1999: 129–130).

Correct attribution of the name. The type specimens of *P.* (*A.*) *actis* are rather robust and they leave no doubt as to their specific distinctness from the taxon referred to under this name by Hesselbarth *et al.* (1995), thus confirming what was already apparent from an attentive study of the original description and illustration by Herrich-Schäffer, as well as from that of *L. atys* Gerhard, [1851] and of *L. athis* Freyer, [1851]. It appears that the taxon denoted as "*Polyommatus* (*Agrodiaetus*) *actis* (Herrich-Schäffer, [1851])" by Hesselbarth *et al.* (1995) and subsequent authors, or at least its Taurus populations, was unnamed yet. Freyer's *athis* indeed applies to a blue butterfly "usually looking like *alexis* [*P. icarus*] on the upperside", while the butterfly with black suffusion in the distal part of the hindwings is considered as "a very nice form" but not named. The application of the name *athis* by several subsequent authors to denote this form is thus probably unjustified, although it must be said that specimens of the smaller and darker taxon without any black suffusion exist as well. As no extant types of *athis* are known however, and in the interest of nomenclatural stability, it is best to follow current use in considering it as a subjective synonym of *actis*. The name *lunulata*, attributed to material from the Sultan Dağları, applies to an aberration and is thus unavailable. Carbonell's (1997) name *artvinensis* applies to populations from the provinces of Erzurum and Artvin in northeastern Turkey, that look quite different from populations of "*actis* sensu Hesselbarth *et al.* (1995) et sqq." and that have a different haploid chromosome number.

Current problems and provisional arrangement. True *actis*, the taxon *firdussii* [pro parte!] of Hesselbarth *et al.* (1995), most probably consists of more than one species, but the picture is not quite clear. The intensity of the blue colour (even leaving *sertavulensis* and *ernesti* aside) varies from vivid violet blue to a lighter blue (especially in *firdussii* from the Elburs), and the variation in colour does not always coincide with that in chromosome numbers (de Lesse, 1960: 186–197, 1962: 66–70). The following haploid chromosome numbers (CN), determined in metaphase I (I) and in metaphase II (II), have been found in populations ascribed to *actis*, *firdussii* or *pseudactis* (after de Lesse, 1960, 1962; Hesselbarth *et al.*, 1995; Lukhtanov *et al.*, 1998; Lukhtanov, unpublished):

CN (*n*)	Locality	Number and stage of cells examined	Name used in original publication	Literary source
27	E Bürücek (İçel, Tekir, TR)	5 (I), 1 (II)	*A. actis* ssp.	de Lesse (1962)
27–28	İvrız, Pozantı (Konya & Adana, TR)	?	*firdussii*	Hesselbarth *et al.* (1995)
23–24	Aladağları, 15 km SE Çamardı (Niğde, TR)	?	—	Lukhtanov (unpubl.)
24 25	25 km N Erzincan (TR)	1 (I) 2 (I), 1 (I, II)	*A. actis pseudactis* Forst.	de Lesse (1962)
30 31 32	Kopdağı Geçidi (Erzurum/ Bayburt, TR)	1 (I) 3 (I, II) 3 (I, II), 1 (II)	*A. actis pseudactis* Forst.	de Lesse (1962)
27 28 29	Mirgemir Dagh [Tahir Geçidi, Ağrı, TR) 1 (II)	1 (I, II) 8 (I), 2 (I, II), 1 (I), 1 (II)	*A. actis pseudactis* Forst.	de Lesse (1962)
28 (27–29)	Kuzgunkıran Geçidi (Bitlis, TR)	?	*firdussii*	Hesselbarth *et al.* (1995: 705, Tab. 20)
25–26 25 25 + m		? (Forster, 1956) 8 (I) 3 (I)	*P.* (*A.*) *firdussii* (1995: 733) *P.* (*A.*) *firdussii pseudactis* (Forster, 1960)	Hesselbarth *et al.* Lukhtanov *et al.* (1998)
25 (25–26) 25	N Çatak (Van, TR) 32 km NNE Çatak (Van, TR)	? 8 (I)	*firdussii* *P.* (*A.*) *firdussii pseudactis* (Forster, 1960)	Hesselbarth *et al.* (1995) Lukhtanov *et al.* (1998)
ca. 21–23 22 23 ca. 21–22	Güzeldere Geçidi (Van, TR)	? 3 (I) 3 (I) 3 (I)	*P.* (*A.*) *firdussii* (Forster, 1956) *P.* (*A.*) *firdussii pseudactis* (Forster, 1960)	Hesselbarth *et al.* (1995: 733) Lukhtanov *et al.* (1998)
28	Pass E. Tabrīz (Āzarbāyjān-é Sharghī, Iran)	2 (I), 1 (II)	*A. actis* ssp.	de Lesse (1962)
31 32 33–34	Damāvand (Tehrān, Iran)	1 (I), 2 (I, II) 1 (I), 1 (I, II) 1 (33:I), (33–34: II)	*A. actis Firdussi* Forst.	de Lesse (1962)
32	"Ab e Ali (Elbourz)" (Iran)	1 (I), 1 (II)	*A. actis Firdussi* Forst.	de Lesse (1962)

It thus appears that not only variability in the number of bivalents is encountered, but also the presence or absence of a small extra element (m), while variability in specimens from different

localities (often at close range, compare e.g. material from Van and Çatak, both in the province of Van in SE Turkey) is significant (Lukhtanov *et al.*, 1998: 3, 6). Matters are further complicated by notable differences in karyotype, even between allopatric populations with a similar chromosome number (e.g. Bürücek, Mirgemir Dagh [Tahir Geçidi] and Tabrīz), suggesting a possibly different organisation of the hereditary material with a resulting degree of intersterility (de Lesse, 1962: 70).

In order to ever be able to ascribe any population unambiguously to any given taxon, it is necessary to study the karyotype and chromosome number of topotypical *actis*, *firdussii*, *pseudactis*, *sertavulensis* and *ernesti* (there are no data at hand for the two last-named nominal taxa), and to combine these data to those obtained after a study of the phenotype and karyotype of any given population. Cross-breeding studies between several populations would further deepen our insight into this interesting case.

For the time being, the following arrangement seems to offer a fair provisional solution (only the holotype or lectotype of each nominal taxon is listed):

Polyommatus (*Agrodiaetus*) *actis* (Herrich-Schäffer, 1851)

"[*Lycaena*] *Actis* Kad." Herrich-Schäffer, G. A. W., [31.XII.1851]. Systematische Bearbeitung der Schmetterlinge von Europa, zugleich als Text, Revision und Supplement zu Jakob Hübner's Sammlung europäischer Schmetterlinge, Vol. 6(48), 24; "[*Lycaena*] *Actis*", Vol. 1(49), Tab. 104, [Figs] 496–499 [31.XII.1851]; "*Lycaena Actis*", Vol. 6(55), Systema Lepidopterorum Europae. Systematisches Verzeichniss der Europäischen Schmetterlinge 4 [31.XII.1852]; "*actis* (*Lycaena*) Kad. HS. 466–469. *athis* Fr.", Vol. 1(65), Index 1 [31.XII.1854]; "*Actis* dazu *Atys* Gerh." Vol. 6(69), 167 [31.XII.1856]; "*actis* Lycaena" Vol. 6(69), Index Universalis Macrolepidoptera 1 [31.XII.1856]. Type locality: Turkey, Tokat province, env. Tokat **(corrected here)**. Type material: lectotype ♂, Turkey, "Amasia" (recte Tokat), VII.1849, leg. Albert Kindermann, in coll. Museum für Naturkunde der Humboldt-Universität zu Berlin (see above).

"[*Lycaena*] *Atys*. Kind. *Actis*. Herr.-Schaeff." Gerhard, [P.] B., [31.V.1851]. Versuch einer Monographie der europäischen Schmetterlingsarten: *Thecla*, *Polyomattus* [sic], *Lycaena*, *Nemeobius*. Als Beitrag zur Schmetterlingskunde, (5), 11, Platte 19, 3 a, b ♂, c, d ♀. Type locality: Turkey, Tokat province, env. Tokat **(corrected here)**. Type material: presumably lost. Subjective synonym of [*Lycaena*] *actis* Herrich-Schäffer, 1851 (Herrich-Schäffer, [1856], 6(69): 6).

"[*Lycaena*] *Atys* Kind. i. l." Heydenreich, [G. H.], [31.VIII.]1851. Lepidopterorum Europæorum Catalogus methodicus. Systematisches Verzeichniss der europaeischen Schmetterlinge, 3. Aufl., 13. — ***nomen nudum***.

"*Lycaena* Pap.[ilio] *Athis*." Freyer, C. F., [31.XII.1851]. Neuere Beiträge zur Schmetterlingskunde mit Abbildungen nach der Natur, Vol. 6(96), 147. Type locality: Turkey, Tokat province, env. Tokat **(corrected here)**. Type material: not found. Subjective synonym of [*Lycaena*] *actis* Herrich-Schäffer, 1851 (Herrich-Schäffer, [1854], 1(65): Index 1).

Polyommatus (*Agrodiaetus*) *firdussii* (Forster, 1956)

"*A.*[*grodiaetus*] *damone firdussii* ssp. nov." Forster, W., 1956. Bausteine zur Kenntnis der Gattung *Agrodiaetus* Scudd. (Lep. Lycaen.) I. — *Z.wien.ent.Ges.* 41: 58–59, Taf. 8–9, Figs 16, 17. Type locality: "Nordiran, Schahkuh, Westabhang, Geröllzone, 1800–2000 m". Type material: holotype ♂, Iran, Māzandarān province, Shāhkūh, leg. Exp. Wernicke, in coll. Zoologische Staatssammlung München.

Polyommatus (*Agrodiaetus*) *pseudactis* (Forster, 1960), species incertae sedis

"*A.*[*grodiaetus*] *actis pseudactis* ssp. nov." Forster, W., 1960. Bausteine zur Kenntnis der Gattung *Agrodiaetus* Scudd. (Lep. Lycaen.) II. — *Z.wien.ent.Ges.* 45: 107–109, Taf. 10–11, Figs 4, 5. Type locality: "Armenia, mts. Daralagez, pag. Martiros, ca. 2000 m alt.". Type material: holotype ♂, Armenia, Daralagez Mts., Martiros, leg. Leo Sheljuzhko & Nina Pavlitzkaja, in coll. Zoologische Staatssammlung München.

"*Polyommatus actis* H.-S. ssp. *pseudactis* Forst." Wiltshire, E. P., 1957. The Lepidoptera of Iraq, p. 30. — ***nomen nudum***.

Polyommatus (*Agrodiaetus*) *sertavulensis* (Koçak, 1979), species incertae sedis

"*Agrodiaetus* (s. str.) *pseudactis sertavulensis* n. subsp." Koçak, A. Ö., 1979. Studies on the family Lycaenidae II. New taxa and records from Turkey. Lycaeniden-Studie II. Neue Taxa und Meldungen aus der Türkei (Lep. Lycaenidae). — *Atalanta* (*Würzburg*) 10(4a): 323–324, Fig. 31. Type locality: "South Turkey, Konya Prov. Sertavul Paß 1600 m". Type material: holotype ♂, Turkey, Karaman province, Sertavul Geçidi, leg. Ahmet Ömer Koçak, in Department of Zoology, University of Ankara.

Polyommatus (*Agrodiaetus*) *ernesti* Eckweiler, 1989, species incertae sedis

"*Polyommatus* (*Agrodiaetus*) *firdussii ernesti* subspec. nov." Eckweiler, W., 1989. Drei neue Lycaeniden aus der Türkei (Lepidoptera, Lycaenidae). — *Nachr.ent.Ver.Apollo*, N. F. 10(2): 97–101, Abb. 35–40. Type locality: "Türkei, Prov. Antalya, Elmalı, Kohu Dağları, Dokuz Gölü, 1700–2000 m". Type material: holotype ♂, Turkey, Antalya province, Elmalı, Kohu Dağları, Dokuz Gölü, leg. et coll. Wolfgang Eckweiler.

Polyommatus (*Agrodiaetus*) *artvinensis* (Carbonell, 1997)

"*Agrodiaetus actis artvinensis* n. ssp." Carbonell, F., 1997. Contribution à la connaissance du genre *Agrodiaetus* Hübner (1822), *Agrodiaetus actis artvinensis* n. ssp. en Turquie orientale, (*Lepidoptera: Lycaenidae*). — *Linn.belg.* 16(4): 140–141, pl. coul., figs 1–3. Type locality: "gorge après Tortum, 1400 m, prov. Erzurum". Type material: holotype ♂, Turkey, Erzurum province, gorge near Tortum, leg. J. Salmon, in coll. Muséum National d'Histoire Naturelle, Paris.

Polyommatus (*Agrodiaetus*) *sigberti* Olivier, van der Poorten, Puplesiene & De Prins, 2000

"*Polyommatus* (*Agrodiaetus*) *sigberti* sp. nov." Olivier, A., van der Poorten, D., Puplesiene, J. & De Prins, W., 2000. *Polyommatus* (*Agrodiaetus*) *artvinensis* stat. nov. and *P.* (*A.*) *sigberti* sp. nov., two vicariant species known so far only from Turkey (Lepidoptera: Lycaenidae). — *Phegea* 28(2): 61–63, 67–73, col. pls 1 & 2, figs 17–32. Type locality: "Turkey, Kayseri province, Aladağları E. side, 34 km S. Yahyali, 2800–2900 m, St. 2384". Type material: holotype ♂, Turkey, Kayseri province, Aladağları E. side, 34 km S. Yahyalı, 2800–2900 m, St. 2384, leg. W. De Prins, A. Olivier & D. van der Poorten, in coll. Instituut voor Systematiek en Populatiebiologie, Zoölogisch Museum Amsterdam.

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249–250, 253–255, 257–259, 261–263, 265–266, 269–270, (1911); 25 (1–14): 2–7, 9–11, 13–17, 22–23, 25–27, 33–34, 37–39, 45–46, 49–50, 61–63, 69–70, 82–84 (Nachtrag), (1911).

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Comparative data on the adult biology, ecology and behaviour of species belonging to the genera *Hipparchia*, *Chazara* and *Kanetisa* in central Spain (Nymphalidae: Satyrinae)

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Summary. The potential longevity, fecundity, mating frequencies, behaviour, and seasonal reproductive biology were studied in several satyrine butterflies belonging to the genera *Hipparchia*, *Chazara* and *Kanetisa*, in an area located in central Spain. All the species studied appear to be potentially long-lived, and a relatively long period of preoviposition is shown to occur in *C. briseis* and *K. circe*. Potential fecundity varies between 250 and 800 eggs depending on the species (with maxima exceeding 1300 eggs in *K. circe*). The results are discussed in terms of the possible ecological relationships between adult ecological traits and the species abundance, and the possibility of a marked geographic variation between species, that might be of interest in relation to specific management and conservation.

Zusammenfassung. Für mehrere Vertreter der Gattungen *Hipparchia, Chazara* und *Kanetisa* (Satyrinae) wurden in einem Gebiet in Zentralspanien potentielle Lebensdauer, potentielle Fekundität, Paarungshäufigkeiten im Freiland und saisonaler Verlauf der Reproduktionstätigkeit untersucht. Alle untersuchten Arten sind potentiell langlebig, eine relativ lange Präovipositionsperiode tritt bei *C. briseis* und *K. circe* auf. Die potentielle Fekundität variiert je nach Art zwischen 250 und 800 Eiern (mit einem Maximum von über 1300 Eiern bei *K. circe*). Die Befunde werden diskutiert im Hinblick auf mögliche Zusammenhänge zwischen ökologischen Charakteristika der Imagines und der Abundanz der einzelnen Arten, sowie unter dem Gesichtspunkt, daß ausgeprägte geographische Variabilität in den ökologischen Eigenschaften auch für spezifische Management- und Naturschutzplanungen bedeutsam sein kann.

Résumé. Le potentiel de longévité, la fécondité, la fréquence d'accouplement, le comportement et la reproduction saisonnière ont été étudiés chez plusieurs espèces appartenant aux genres *Hipparchia*, *Chazara* et *Kanetisa* (Satyrinae), dans une région localisée au centre de l'Espagne. Toutes les espèces étudiées paraissent avoir potentiellement une longue vie, *C. briseis* et *K. circe* montrant une période de préoviposition relativement longue. La fécondité potentielle varie entre 250 et 800 œufs selon l'espèce (avec un maximum de plus de 1300 œufs pour *K. circe*). Les résultats sont discutés en termes de relations écologiques possibles entre les exigences écologiques des adultes et l'abondance des

espèces, et la possibilité de variations géographiques marquées entre espèces, ce qui peut être intéressant à relier à des mesures spécifiques d'aménagement et de protection.

Key words: Lepidoptera, Nymphalidae, Satyrinae, fecundity, life history, longevity, mating frequency, seasonality, Spain.

Introduction

Some adult life history traits such as potential longevity and fecundity may have a relevant bearing on other ecological features of practical interest, like the ability for dispersal, the capability for colonisation, or the potential for population growth (e.g. Young, 1972; Spitzer *et al.*, 1984; Bink & Siepel, 1986). In spite of the fact that the members of the superfamily Papilionoidea have been thoroughly studied in the Western Palaearctic, detailed data on their reproductive biology are largely confined to a relatively small number of target species.

This work intends to present some basic features of the adult reproductive biology of *Hipparchia alcyone* ([Denis & Schiffermüller], 1775), *H. statilinus* (Hufnagel, 1766), *H. fidia* (Linnaeus, 1767), *Kanetisa circe* (Fabricius, 1775) and *Chazara briseis* (Linnaeus, 1764), with comparative data on *H. semele* (Linnaeus, 1758) in central Spain. The main adult life history traits involved are potential longevity, female potential fecundity, temporal distribution of oviposition in the wild, mating frequencies as estimated by spermatophore counts, and a general description of the activity of the insects in the field. The results are largely based on data collected more than ten years ago for a comparative study on Spanish *Hipparchia* (García-Barros, 1988a), to which new field and rearing data were added.

All the species involved are strictly univoltine across their range, and hibernate as small larvae (usually 1st or 2nd instar larvae, depending on species and locality — Bink, 1992a and references below). Life history data from *H. statilinus* and *H. fidia* in central Iberia can be found elsewhere (García-Barros, 1989a, 1989b; see also Jutzeler, 1993; Jutzeler *et al.*, 1998). Available information on local larval host plants of the species involved is summarised by Munguira *et al.* (1997). The female reproductive biology of *H. semele* in the study area has been dealt with in detail elsewhere (García-Barros, 1988b, 1989a, 1992), and thus only some un-

published details on the behaviour of this species are included here. This grayling is characteristic with a long flight period much alike that of *K. circe* and *C. briseis* described below; the females undergo delayed ovarian maturation throughout the driest part of the summer, and are plugged during copulation so that female monogamy is obligatory. The adults of *K. circe* and *C. briseis* occur all along the summer in the study area, from the beginning of July until September (early males can be seen in June, or even late May at especially warm locations). *H. alcyone* has a shorter flight period (July to late August or early September). The adults of *H. fidia* and *H. statilinus* are the latest to emerge (mid July, with fresh females still appearing 1 to 15 August) and remain on the wing until mid or late September. Except for *H. alcyone*, some adults may stay alive as late as early October when early autumn is sunny and dry.

Methods

Data from captive insects were derived from small numbers of adults obtained from larvae, either reared in the laboratory or collected in the study area described below. Once mated, the females were kept in individual voliaries and the eggs laid were counted daily (as described in García-Barros, 1988b). Potential fecundity was calculated as the sum of all the eggs laid by one female (realised fecundity) plus all chorionated eggs contained in the abdomen of a dead insect, counted after dissection. The males were maintained in small groups (4–10 individuals) in larger cages (1 m^3). The rearing cages were placed outdoors in a grassy outer yard at the Universidad Autónoma (Madrid) in a sunny exposure, in a way such that a shadowy shelter was available within the voliary allowing the insects to avoid overheating. Environmental conditions were not controlled or measured. Weather was usually fine to hot during the season when adults were available (July and August), so that oviposition normally proceeded in a more or less continuous manner during a female's life period.

Field work was carried out at 15 sites within a 40 × 30 km area surrounding the artificial lake of Entrepeñas, in the province of Guadalajara (central Spain), at elevations between 700 and 900 m. Preliminary field work was directed to obtain estimates of the

species' abundance and site specificity. First, the study area was divided in 48 squares of 5 × 5 km. An area with reasonably well preserved vegetation (usually consisting of succession stages of *Quercus ballota* or *Q. faginea* woodlands) was selected within each square, and assessed four times (once per 15 days during July and August 1984) for the presence of each species. Second, 15 sites that proved particularly suitable for at least one of the species studied, were selected for regular sampling. Transect surveys (500 × 5 m) were carried out at these locations every ten days during two seasons (June to October, 1985–1986), using a procedure basically similar to that popularised by Pollard *et al.* (1975), but with explicit reference to a known area extension. The data from the main flight period (July and August) were then used to calculate the average number of butterflies per area unit.

Further field observations were conducted in order (1) to determine the reproductive condition of wild females, (2) to estimate the change in wing wear condition along a season, and (3) to quantify the patterns of activity displayed by the two sexes of each species. Field observations on *C. briseis* were restricted to step 1 since, although spread across the study area, this hermit was comparatively scarce in most of the sites prospected (see Table 1).

Table 1. Species abundance in the study area, as derived from counts of adult insects and presence/absence data: Mean number of adults per hectare (mean and standard deviation in 15 sites), percentage of sites where the species was collected (15 sites – 100%), and percentage of 5 km squares (48 squares – 100%) in the study area where each species was observed. For comparative purposes, data from taxonomically allied species (*Satyrus* series) that occur in the area are given. These are, in addition to the species dealt with in this study: *Hipparchia semele* (L., 1758), *Arethusana arethusa* ([D. & Schiff.], 1775), and *Satyrus actaea* (Esp., 1780).

Species	Mean population density		Area coverage	
	Mean	s.d.	% sites	% 5 × 5 km squares
H. alcyone	28.9	42.0	73.3	41.7
H. semele	19.3	19.8	93.3	35.4
H. fidia	15.7	23.9	40.0	43.8
H. statilinus	29.3	24.1	100.0	97.9
C. briseis	2.5	3.2	60.0	37.5
K. circe	14.7	10.9	100.0	72.9
A. arethusa	1.5	3.6	20.0	6.3
S. actaea	2.7	8.3	20.0	8.3

(1) *The reproductive status* of adult females was estimated from subsamples of female insects (up to 10 individuals per site and date) that were transported to the laboratory in a portable fridge within 6 hours after collection, and then dissected or frozen for further dissection. The specimens were checked for the presence of mature eggs within the common oviduct (indicating that the female was ovipositing). The diameter of the largest eggs within the ovaries was measured to the nearest 0.03 mm. The total number of eggs and number of spermatophores within the mating pouch (*bursa copulatrix*) were counted (e.g. Burns, 1968). These results are based on samples taken during two subsequent years. Care was taken to obtain samples of comparable size at least once every ten days each year, to avoid misinterpretations caused by between-year variation.

(2) *Wing wear state*. The transect surveys described above were repeated over the full flight season (June to October). In each transect, all the butterflies were collected to assess their wing state according to the scale 1–4 (where 1 — young to 4 — old).

(3) *Adult activity*. The activity displayed by the adults was recorded along the transect surveys (for obvious reasons this had to be done before assessment of wing states). Apparently resting individuals that were suspected to have been disturbed by the researcher were observed for one to five minutes, and then classified as resting unless other activity was displayed in that period. This proved necessary to prevent inflated records of "resting" individuals that might actually represent cryptic behaviour as a response to the observer's activities. All surveys were conducted between 11.00 and 17.00 hours, in sunny weather and under ambient temperature above 25°C.

Results

Butterfly counts and species frequencies. The estimates obtained are shown in Table 1. The number of adults counted per hectare reached 50, but varied widely depending on the species and location. On average, none of the species studied could be defined as very abundant, with average estimated densities reaching 30 adults/hectare at most.

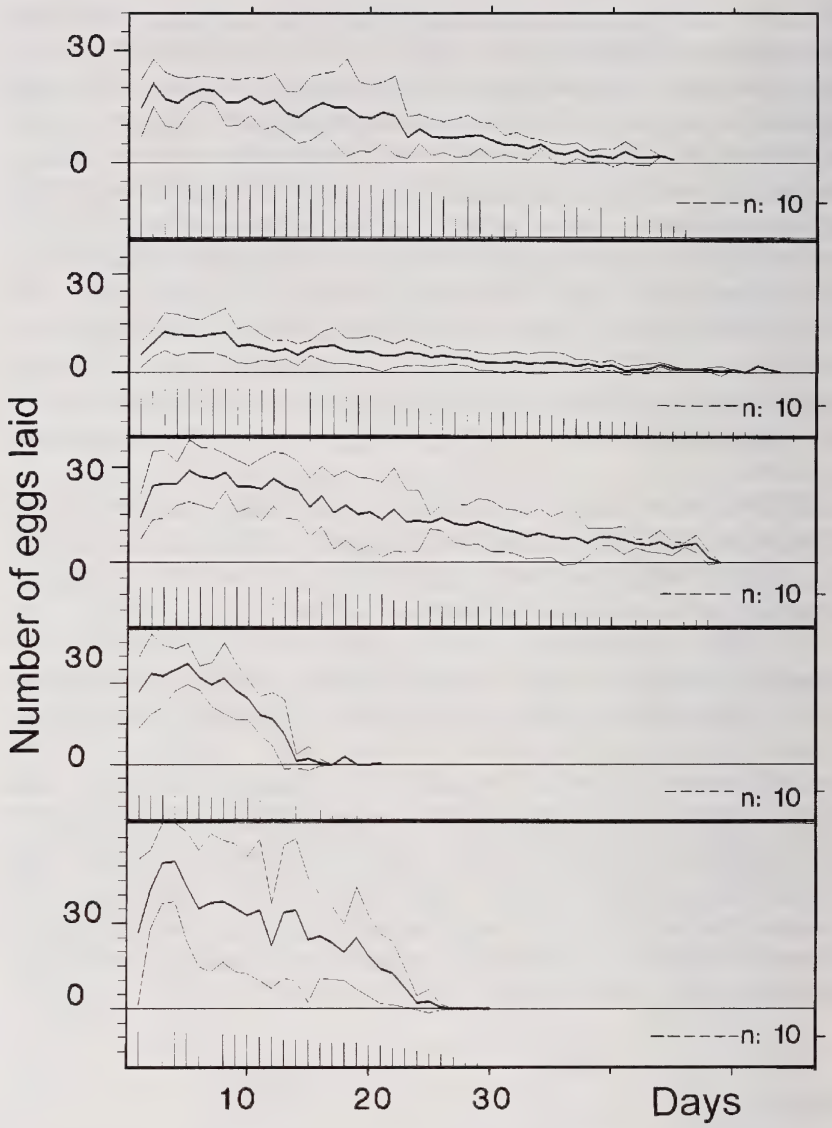

Fig. 1. Average patterns of daily egg production by captive females of (upper to lower): *H. alcyone*, *H. fidia*, *H. statilinus*, *C. briseis* and *K. circe*. Thick line in each graph indicates daily means, and thin lines the value of standard deviation above and below the mean. Sample sizes (number of females alive on date d) are given by the bars in the lower part of the plots (scale in lower right angle). In all instances, date 1 is the first day of oviposition.

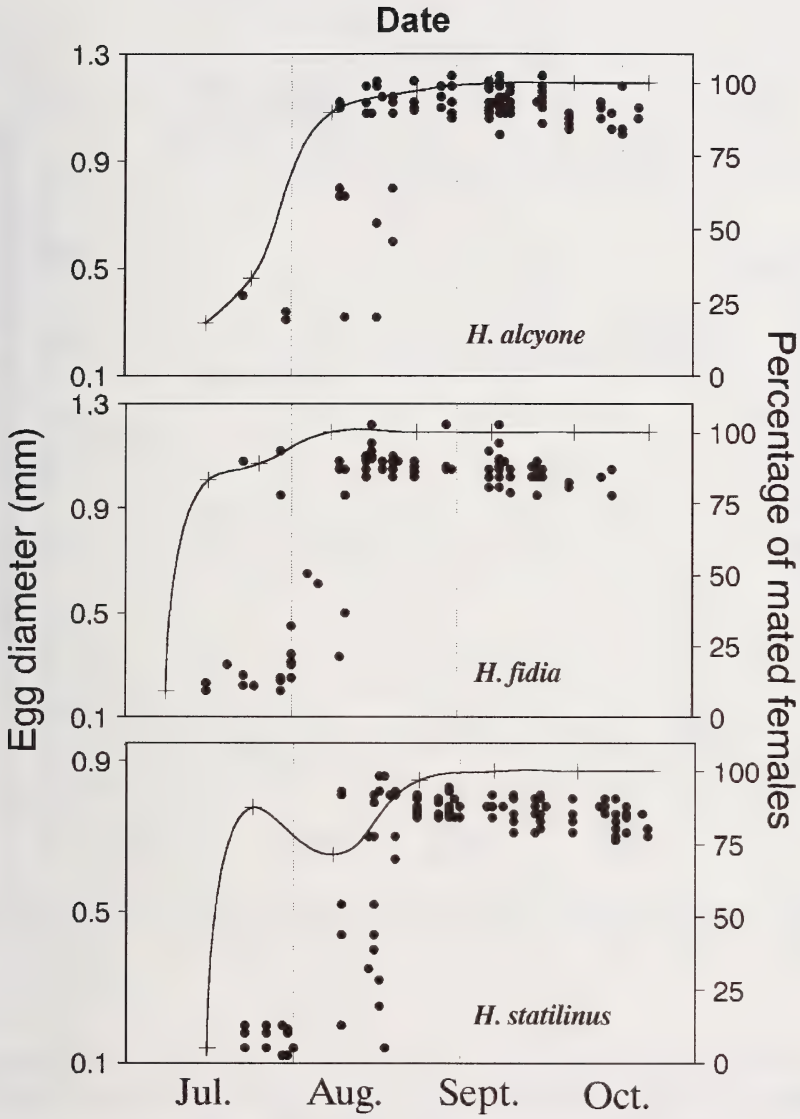

Fig. 2. Reproductive status of wild females of *H. alcyone* (upper), *H. fidia* (centre) and *H. statilinus* (lower). Dots represent the diameter of the widest eggs contained in the abdomen (in mm, left scale in all plots). The crosses indicate the percentage of mated females plotted on 15-days intervals (right scale; the continuous line is simply a smoothed line connecting the successive percentages). The number of individuals dissected per date is not proportional to the actual abundance of the species on that date.

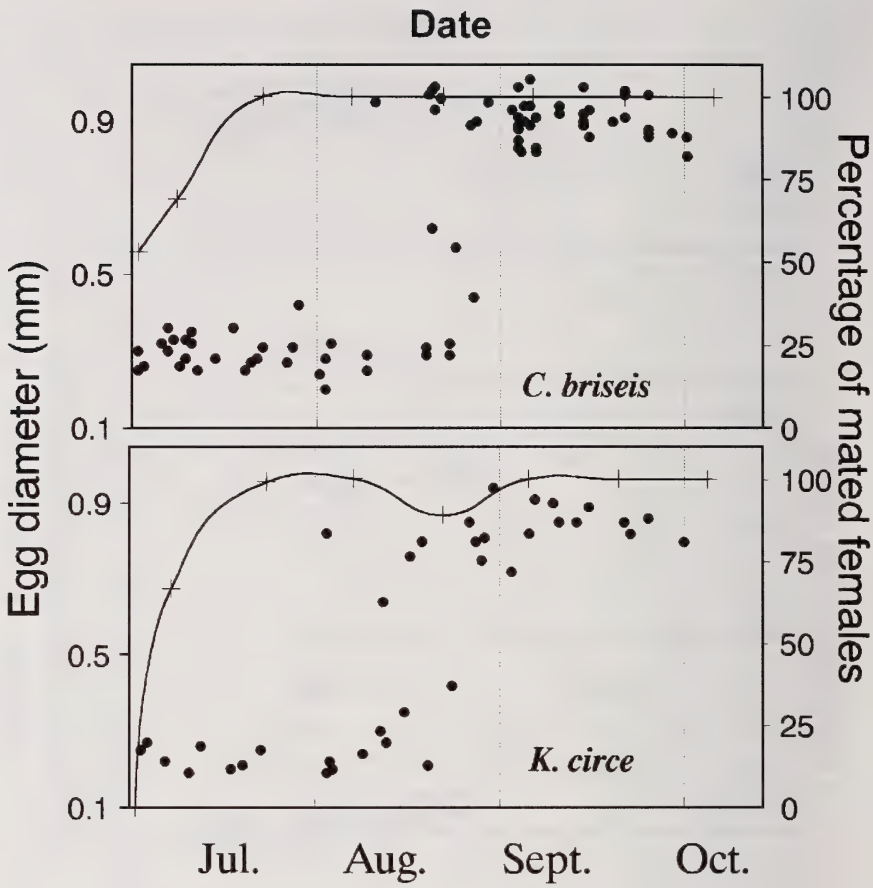

Fig. 3. Reproductive status of wild females of *C. briseis* (above) and *K. circe* (below). Details as in Fig. 2.

Longevity and reproductive performance. The results concerning laboratory observations, as well as those from dissection of females from the wild, are summarised in Table 2. The temporal patterns of oviposition of captive females are shown in Fig. 1, and the reproductive status of wild females is represented in Figs 2 and 3. It was evident that the females of all the species required no less than four days to reach ovarian maturation. The dissection of small series of adult females of *H. alcyone* and *H. fidia* aged 1 to 10 days

Table 2. Summary of data concerning longevity, and several features of the female reproductive biology in the five species under study. Unless otherwise stated, the data represent average ± standard deviation (range of variation, *n* – sample size, [1] – sample size as for female longevity).

	H. alcyone	*H. fidia*	*H. statilinus*	*K circe*	*C. briseis*
Male longevity (days)	33.7 ± 14.1 (10-58) n = 34	50.9 ± 24.6 (10-88) n = 13	47.3 ± 17.3 (14-63) n = 16	25.1 ± 21.5 (ó-43) n = 12	17.6 ± 10.8 (12-35) n = 5
Female longevity (days)	33.7 ± 14.1 (25-54) n = 14	50.9 ± 24.6 (17-68) n = 15	47.3 ± 17.3 (29-59) n = 12	25.1 ± 21.5 (22-58) n = 12	17.6 ± 10.8 (21-42) n = 10
Preoviposition (days) [1]	6.7 ± 1.8 (4-9)	5.4 ± 1.5 (3-9)	6.8 ± 2.3 (4-11)	18.3 ± 10.6 (13-28)	19.6 ± 5.5 (12-30)
Oviposition (days) [1]	29.2 ± 9.1 (17-44)	33.3 ± 13.9 (12-54)	37.1 ± 8.9 (19-48)	18.1 ± 9.2 (9-30)	14.7 ± 4.5 (9-21)
Realised fecundity [1]	368.6 ± 157 (98-634)	217.7 ± 98 (85-343)	598.4 ± 187 (232-820)	665.8 ± 399.1 (235-1357)	339.9 ± 73.5 (252-473)
Potential fecundity [1]	467 ± 115 (336-696)	254 ± 94 (108-356)	756 ± 86 (642-894)	799.8 ± 307.9 (600-1360)	779.7 ± 138.9 (552-962)
Mean daily fecundity [1]	12.9 ± 5.7 (5-26)	6.7 ± 2.4 (4-11)	16.6 ± 5.1 (6-24)	36.2 ± 6.6 (3-50)	28.2 ± 7.3 (19-42)
Maximum daily fecundity [1]	32.3 ± 6.9 (24-42)	14.1 ± 3.8 (9-22)	33.8 ± 6.9 (25-43)	65.9 ± 23.7 33-115)	44.1 ± 6.0 (37-51)
Percentage of mated females (field samples)	96.6	95.5	91.9	93.9	92.1
Mean number of spermatophores in mated females (fleld)	1.16 ± 0.43 0-3 n = 84	1.14 ± 0.38 0-3 n = 84	1.12 ± 0.33 0-2 n = 102	1.03 ± 0.16 0-2 n = 78	1.00 ± 0.00 0-1 n = 37

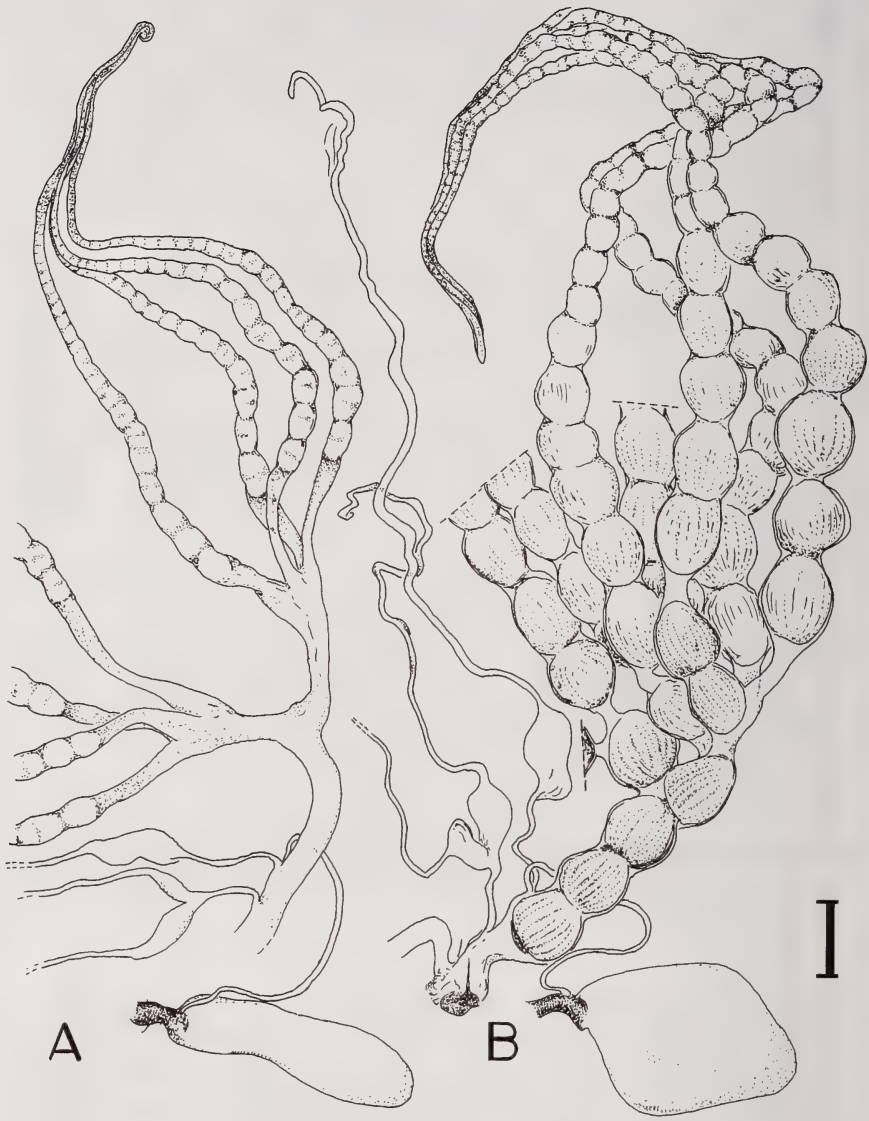

Fig. 4. Comparison between the female reproductive tracts of two *H. alcyone* females of different age: A – 24 hours after emergence, and B – a 10 days old female on its first day of oviposition. A part of the ovarioles omitted for clarity (reference bar – 1 mm).

confirmed that the absence of oviposition during early adult life was due to the fact that females were reproductively immature upon emergence (Fig. 4), and was not an artefact caused by rearing procedures.

Wing state distribution and seasonal variation. Since wing state was correlated to observation date (as expected, see Fig. 5), an analysis of the variance with observation date (date 1 — June 1) as the covariate was used to compare male and female average wing wear controlling for the effect of capture date. The effect of the covariate (date) was always significant ($F > 594$ in all instances, $P < 0.0001$, 1.d.f.). Between-sex differences were significant for the four species tested (in all instances $P < 0.001$, 1.d.f.): *H. alcyone* ($F = 857.8$), *H. fidia* ($F = 63.33$), *H. statilinus* ($F = 902.4$), and *K. circe* ($F = 70.0$). In summary, the degree of wing wear differs between sexes within each species, if dates are kept constant.

In order to detect between-sex differences in the seasonal progression of wing status, the slopes of the regression lines of male and female individuals within each species were subsequently compared. The interaction between the variables "sex" and "date" was examined in an analysis of the variance of "wing state", where "sex" was set as the classification factor and "date" as a covariate (GLM procedure). Evidence for heterogeneity of the slopes arose for *H. statilinus* ($F = 9.39$; $P = 0.002$, d.f . = 1) and *K. circe* ($F = 4.43$; $P = 0.037$, d.f. = 1), but not for *H. alcyone* ($F = 0.23$; $P = 0.628$, d.f. = 1) or *H. fidia* ($F = 1.56$; $P = 0.213$, d.f. = 1) (see Fig. 5).

Fecundity, species abundance, and site specificity. The estimates of fecundity obtained in the laboratory were compared with the data in Table 1 for *Hipparchia* spp., *C. briseis* and *K. circe*. Fecundity was not correlated with the species mean densities, although it was related to the dispersion across the study area (measured as the number of study sites where a species was recorded, see Table 1 (Fig. 6). No other obvious relationships were obtained (results not given in detail). Such comparisons are probably meaningless because of the small number of species included. In any case, it is interesting to note that there is some degree of correspondence between range size and potential fecundity across the study sites.

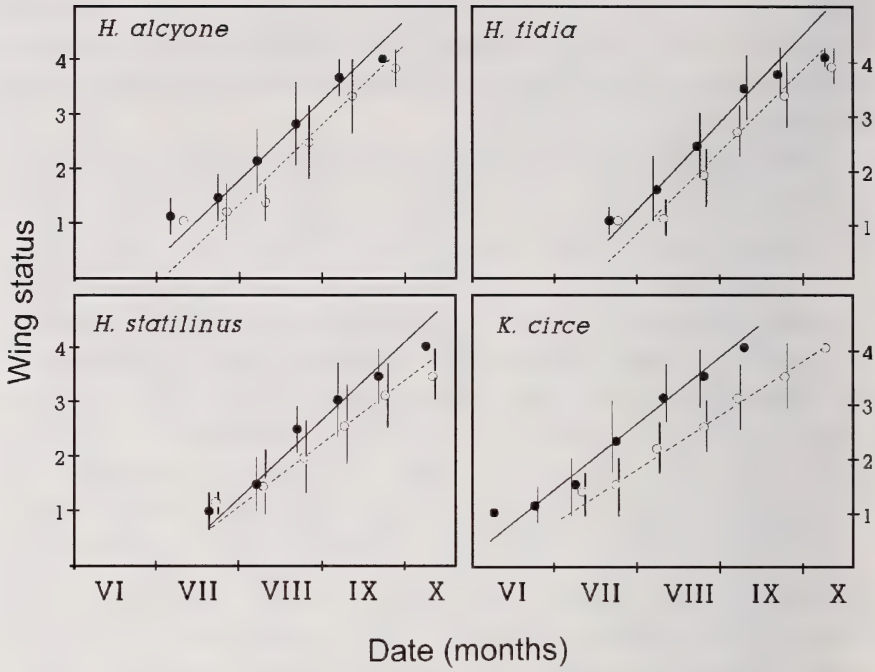

Fig. 5. Relationship between wing state and date in males (solid line, filled dots) and females (dashed lines, circles) of *H. alcyone*, *H. fidia*, *H. statilinus* and *K. circe*. The dots represent average values for each 15-days period (vertical bars – 2 × s.d.). Regression lines for males and females in each species are (*WS* – wing state, *D* – date where 1 – June 1): *H. alcyone* — $WS_{males} = -8.52 + 0.049(D)$, $WS_{females} = -9.43 + 0.050(D)$; *H. fidia* — $WS_{males} = -10.0 + 0.053(D)$, $WS_{females} = -9.37 + 0.048(D)$; *H. statilinus* — $WS_{males} = -8.90 + 0.048(D)$, $WS_{females} = -7.12 + 0.039(D)$; *K. circe* — $WS_{males} = -7.25 + 0.041(D)$, $WS_{females} = -6.24 + 0.03(D)$. Correlations ($r$) are above 0.76 and significant ($P < 0.0001$) in all instances. Sample sizes are those given in Table 3.

Activity and behavioural notes. The summary of adult activities provides a general description that may well fit to intuitive descriptions of the behaviour of the species involved. The males of *Chazara* and *Hipparchia* spp. displayed typical perching behaviour, often fighting for territories. The males of *K. circe* showed a mixed strategy, where patrolling for females (often close to emergence sites in grassy areas) was combined with perching activity. Overall, the group of species under study can be described

as conservative in relation to flight activity. As a general rule, less than 20% of the observations concern what could be described as erratic flight, while a large proportion of records consisted of apparently inactive, or thermoregulating butterflies. Although males and females show sharply different behaviour patterns, the sexes appear not to be very far apart when behaviour is classified into four main categories (as in Table 3). In short, males and females devote broadly similar periods of time to activities related to reproduction, feeding, and displacement. However, these activity schedules involve a significantly higher investment in flight for the male sex, as shown in Table 4. Finally, shifts in activity patterns are obvious for the female sex in all species, while male activity appears to be more constant over the season (*K. circe* males may be an exception: see Table 5).

Incidentally, some differences between the kind of substrates used as perching sites by the males of *Hipparchia* spp. was detected (Table 6). The males of *H. alcyone* and *H. semele* perched more often on tree trunks or low branches, while those of *H. fidia* and *H. statilinus* preferred rocks, stones or decaying wood pieces upon the ground surface. This dichotomy is to some extent parallel to that in the adult wing colour patterns (upperside brown with light band, or uniformly greyish). Although interesting, this may simply reflect the preference of the former two species for woody places in the study area.

As noted for *H. statilinus*, *H. fidia* and *H. semele* (García-Barros, 1989a, 1989b and references therein), the eggs of *C. briseis* and *H. alcyone* were laid singly, most frequently on dry grass stems or other decaying plant material on the ground and more rarely attached to the base of grass tufts. *K. circe* females drop their eggs while settling close to the ground (e.g. Geiger, 1987, and personal observations). This was frequently observed during September. Ovipositing females concentrated at wood margins, road verges, and especially at relatively moist sites around small water courses. The females of this satyrine were observed all along the summer, but they were scarcer and more concentrated in wooded areas during the driest period (mostly August). The adults of this species have a complex biology that probably implies relatively important movements between different areas. Captive females of *K. circe*

have been reported to stridulate, probably as a part of their behaviour to reject courting males (García-Barros, 1986), but no further data on this behaviour were obtained in the field.

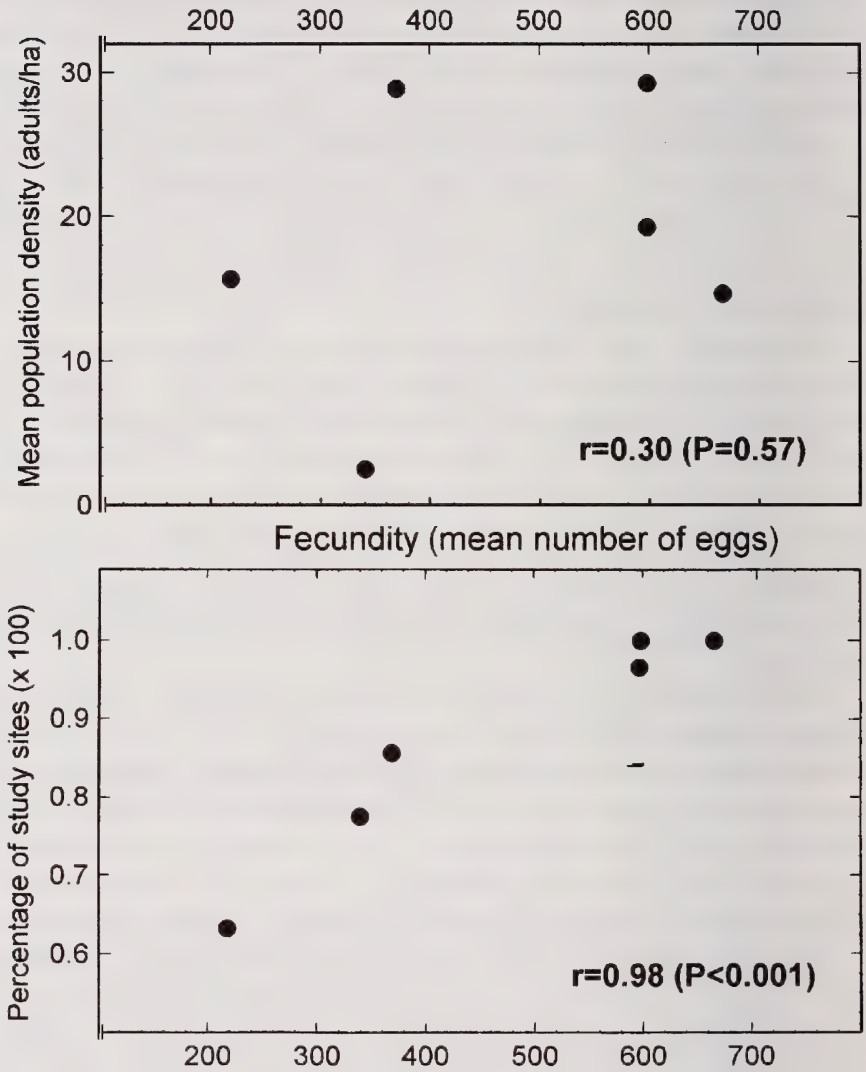

Fig. 6. Interspecific relations between average fecundity and the relative abundance and range size of the species in the study area. Data from Table 1 (data on egg production by *H. semele* from García-Barros, 1988b, 1992).

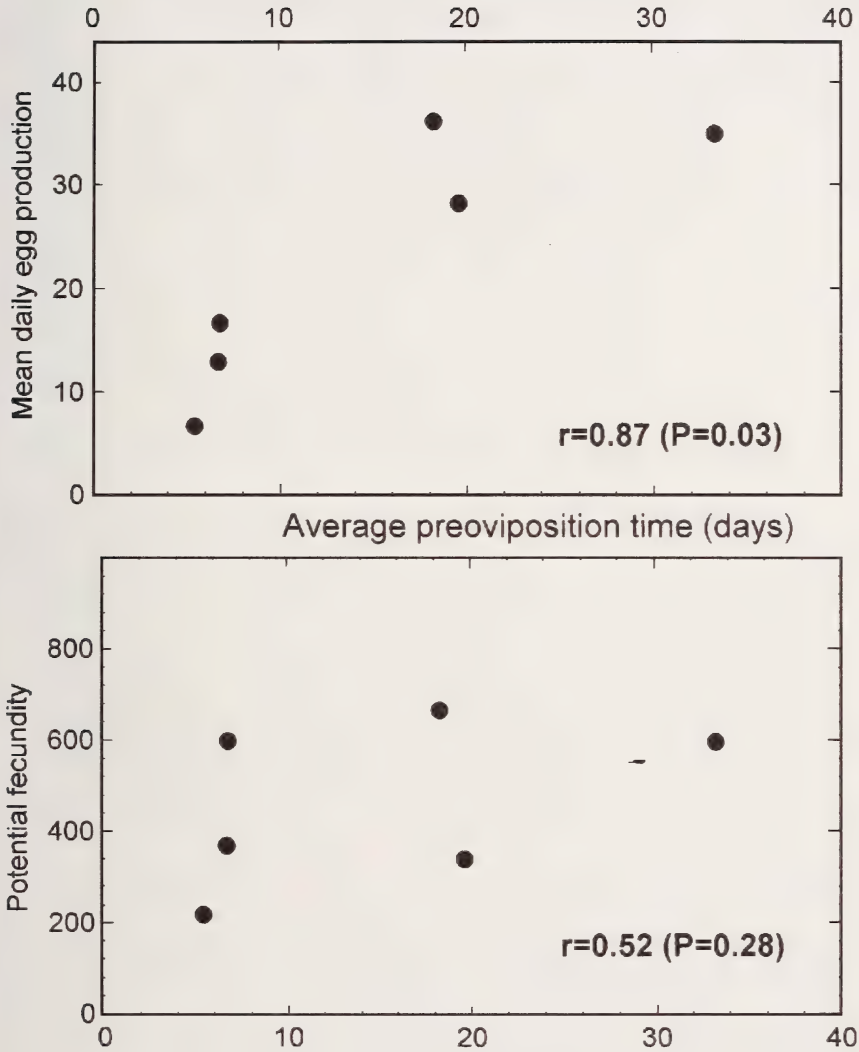

Fig. 7. Interspecific relationships between the average time required to lay the first egg (preoviposition), and both potential fecundity (number of eggs) and mean daily egg production in laboratory reared females. Based on the data from the species included in the study plus *Hipparchia semele* (from García-Barros, 1988b, 1992).

Table 3. Frequency distribution of main activity types in males (m) and females (f) within each species, expressed as a percentage of the total number of records (*n* – sample size). *B* – resting or basking, *R* – reproduction and related activities (including courtship, territorial defence, mating and oviposition), *F* – flying (erratic flight), *N* – feeding. The differences tested are between sexes within each species (χ^2, 3 d.f.).

Species	Sex	Activity				n	χ^2 m/h
		B	R	F	N		
H. alcyone	m	49.26	19.70	19.70	11.33	203	
	f	55.14	22.43	15.89	6.54	107	2.94 n.s.
H. semele	m	48.73	20.76	18.22	12.29	236	
	f	58.78	16.03	18.32	6.87	131	5.00 n.s.
H. fidia	m	49.71	22.54	17.92	9.83	173	
	f	53.33	17.78	18.89	10.00	90	0.83 n.s.
H. statilinus	m	45.23	27.39	19.50	7.88	241	
	f	47.27	31.52	15.15	6.06	165	2.17 n.s.
K. circe	m	35.24	13.33	28.57	22.86	105	
	f	50.62	16.05	18.52	14.81	81	7.05 n.s.

Table 4. Comparison between the proportion of males (m) and females (f) in flight (including territorial fights between males) or settled on the ground or other substrates (either active, basking or resting), within each species (*n* – sample size). The value and statistic significance of Chi-square tests between sexes of each species is given (χ^2, 1 d.f.). Sample sizes as in Table 3.

Species	Sex	Activity classes		χ^2 m/h	
		Flying	Settled		
H. alcyone	m	39.41	60.59		
	f	15.89	84.11	18.03	$p < 0.001$
H. semele	m	38.98	61.02		
	f	18.32	81.68	16.64	$p < 0.001$
H. fidia	m	40.46	59.54		
	f	18.89	81.11	12.45	$p < 0\ 001$
H. statilinus	m	46.89	53.11		
	f	15.15	84.85	43.97	$p < 0.001$
K. circe	m	64.76	35.24		
	f	77.78	22.22	4.15	$p < 0.05$

Table 5. Evidences for seasonal shifts in activity types along the season for adults of *Hipparchia* spp. and *K. circe*. The variable "date" was tested by means of one-way analyses of variance using "activity type" as classification factor (independent ANOVAs for each sex and species). The value of the F statistic is given together with the level of significance (3 d.f.; *** – $P < 0.001$, ** – $P < 0.01$, * – $P < 0.05$, n.s. – $P > 0.05$). Sample sizes as in Table 3.

Species	Sex	F
H. alcyone	m	0.92 (n.s.)
	f	4.42 (**)
H. semele	m	2.03 (n.s.)
	f	6.61 (***)
H. fidia	m	1.50 (n.s.)
	f	3.00 (*)
H. statilinus	m	1.51 (n.s.)
	f	5.02 (**)
K. circe	m	3.81 (*)
	f	6.28 (***)

Table 6. Comparison between the substrates used by perching males of the four species of *Hipparchia* (proportion of males on tree trunks or branches, vs. stones or other substrates at ground level): χ^2 value and level of significance (1 d.f.: *** – $P < 0.001$, ** – $P < 0.01$, n.s. – $P > 0.10$). Sample sizes as in Table 3.

	H. semele	*H. fidia*	*H. statilinus*
H alcyone	1.016 n.s.	67.12***	112.603***
H. semele		57.930***	10.496**
H. fidia			3.093 n.s.

Discussion

Adult butterflies are often regarded as ephemeral organisms, with a short life and relatively fast reproduction. This is by no means a general pattern. The temporal distribution of female reproductive effort of butterflies may in fact be ordered along a continuum (Boggs, 1986; Tammaru & Haukioja, 1996). Female *Hipparchia*, *Chazara* and *Kanetisa* have a potentially long adult life span (in terms of an insect), and at least a few days are required before the eggs mature and are ready to be laid. Ovarian maturation is delayed for no less than two weeks in *K. circe* and *C. briseis* (as in *H. semele*: García-Barros, 1988b). Whether or not long delayed ovarian maturation is a geographically variable trait within species

is central to the interpretation of the observed patterns in terms of intraspecific variation (i.e., at a population or regional level, e.g. García-Barros, 1992 for *H. semele*), or interspecific variation. For instance, the flight period of *C. briseis* in the southern and northern boundaries of its distribution range is apparently uniform (basically, July to September: Seufert & Grosser, 1996), but no evidence for any kind of aestivating behaviour has been recorded from non-Mediterranean populations. According to available evidence, delayed oviposition in this and closely related species with wide geographic distribution has to be interpreted in terms of adaptation to local climate conditions that imply a dry summer period when adequate food plants (grasses) are not suitable as larval food. The species considered show remarkable coincidence in their period of oviposition in the wild, irrespective of their pattern of adult emergence. It could be argued that species where the females undergo a long pre-reproductive life would have comparatively less chances to reach fecundity comparable to those of related species with a more or less immediate oviposition, unless pre-reproductive female mortality was compensated for. This may have important consequences related to adult mortality schedules, and it is thus interesting that there is some coincidence between long pre-reproductive female life and high daily egg production rates among the species studied here which, however, does not result in a correlation between long preoviposition and high potential fecundity (Fig. 7).

Female fecundity varies widely across species, and may reach remarkably high figures in *K. circe* (up to 1300 eggs). The present estimates are well above those presented by Bink (1992a) for the same species (for instance, 140 versus 598 in *H. statilinus*, 250 versus 666 in *K. circe*, 100 vs. 369 in *H. alcyone*). These differences could probably be attributed to the more favourable temperatures experienced by the insects at Madrid (in comparison with The Netherlands), or to geographic variation in the life history traits involved (sharp differences in fecundity and female pre-reproductive life span have been found after comparison of geographically distant populations of *H. semele* — Bink, 1992a; García-Barros, 1992; see also Wiklund & Karlsson, 1988). However, there is the possibility that some of the data on butterfly fecundity by Bink (1992a) have to be critically reviewed on the light of new evidence.

While counts of ripe eggs contained in the abdomen of female butterflies have occasionally been proposed as estimates of potential fecundity (e.g. Ehrlich & Ehrlich, 1978), such procedure is obviously inaccurate in species where egg maturation proceeds along the female's life. Most females in this study died without having laid even all the mature eggs contained in their abdomens. Such counts might, however, represent reasonable approximations to daily egg production under favourable conditions (e.g. compare Table 2 and Fig. 4 for *H. alcyone*). Follicle counts (as used by Braby & New, 1988) may produce less conservative estimates, but still the contents of an individual ovariole can represent a continuum between ca. 0.05 mm and a mature egg (up to 1 mm, depending on species). The results of dissection of wild females show that, while female monogamy is the rule, repeated copulation does sometimes occur (unlike *H. semele* from southern Europe, where multiple mating is usually prevented by a sphragis secreted by the male: García-Barros, 1989a). *C. briseis* females appear to be strictly monogamous, but this might be due to small sample size.

Male and female activity patterns differ not as much in the time spent in activities intended to get food resources or reproductive success, but in the effort required: males invest more energy in flight-related activities. Interestingly, there is evidence for seasonal shifts in activity in the female sex, probably highlighting the importance of seasonal distribution of female activity. This might result from the seasonally uneven distribution of adult food resources, that may be crucial to complete ovarian maturation (cf. Wheeler, 1996). The results show that the females mate relatively soon after emergence (alternatively, the catchability of virgin females is very low). Young mated females probably remain moderately active until the onset of oviposition. The observed pattern would lead to predict different patterns of wing state change along the summer in the female sex. The fact that this is corroborated in only two species (*H. statilinus* and *K. circe*) is difficult to explain, but little else can be said until more accurate methods are applied. Seasonal variation in male behaviour has been found in other satyrines (Wickman & Wiklund, 1983; Wickman, 1992; Van Dyck & Matthysen, 1998), and seasonal changes in behaviour and habitat selection have been reported for satyrines from tropical or

subtropical areas where rainfall is strongly seasonal (e.g. Braby, 1995). What is of interest is that West-Palaearctic satyrine nymphalids are predominantly univoltine (that is, they complete one generation per year), and that this pattern applies as well to the Mediterranean species or populations. Hence, seasonal variation in activity patterns in *Hipparchia*, *Kanetisa* or *Chazara* represents environmental variation that is faced by the individual adults (not by the different individuals belonging to successive generations).

The amount of time spent settling on the ground by the adults of both sexes must be partly attributable to thermoregulating behaviour (since overheating must be a serious risk for several hours a day during the central part of the summer), as well as to the dominating perching strategy used by the males to locate mates.

In summary, that insects such as butterflies have varied and complex life styles is not a surprise. A more detailed knowledge of some key biological traits may help in our understanding of the species responses to environmental changes. As suggested by Bink (1992b), some ecological characters of the adults might prove of predictive value in relation to changes in abundance. More estimates of such traits are required, however, to get an adequate contrast of their reliability and of their possible geographic variation (which in turn constitutes an evidence of genetic diversity). To the extent that such variation occurs, the extrapolation of local results (e.g. for purposes of population management for conservation) may prove inadequate.

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Phantosoma witti gen. et sp. nov., a new autumn lasiocampid moth from Turkmenistan (Lasiocampidae)

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Summary. A new monotypic genus *Phantosoma* gen. nov. is established for a new species *Phantosoma witti* sp. nov. from the Kopet-Dagh Mts., S. Turkmenistan. The systematic position of the taxon within the family Lasiocampidae is still uncertain because only a single female is known.

Zusammenfassung. Eine neue monotypische Gattung *Phantosoma* gen. nov. wird für eine neue Art, *Phantosoma witti* sp. nov. aus Süd-Turkmenistan (Kopet-Dagh-Gebirge), errichtet. Die systematische Position des Taxon in der Familie Lasiocampidae ist unklar, weil nur ein einziges Weibchen bekannt ist.

Résumé. Un nouveau genre monotypique *Phantosoma* gen. nov. est établi pour la nouvelle espèce *Phantosoma witti* sp. nov. des monts du Kopet-Dagh, au sud du Turkménistan. La position systématique du taxon au sein de la famille des Lasiocampidae reste incertaine à l'heure actuelle, vu qu'une seule femelle est connue jusqu'à présent.

Key words: Lasiocampidae, *Phantosoma* gen. nov., *witti* sp. nov., Turkmenistan.

A single female of an unknown lasiocampid moth species was collected in November 1991 in the Kopet-Dagh Mts (south Turkmenistan) by our Hungarian colleagues, Gábor Ronkay and Márton Hreblay. To our surprise, examination of this specimen revealed the necessity to establish a new genus for it.

Phantosoma gen. nov.

Type-species: *Phantosoma witti* sp. nov.
Derivation: phantasma (Gk. appearance, phantom) + soma (Gk. body); gender: neuter.

Diagnosis (female). Lasiocampid moth of small size. Head small; eyes small. Antenna bipectinate, flagellar processes long.

Labial palps (Fig. 2) short, porrect, 3-segmented. Proboscis reduced. Front with longitudinal, sclerotized, wrinkled keel.

Thorax and abdomen strong, covered with long scales. Legs long and slender, without epiphysis (Fig. 3). Abdomen with apical tuft of modified scales forming a pillow at its tip.

Female with developed wings (Fig. 4). Frenulum absent; costal margin of the hindwing slightly extended. Forewing with 5 branches of R: R_1 free; R_2 and R_3 on a long stem, both running to the costal wing margin; R_4 and R_5 on a short stem, both running to outer wing margin; origins of R_2+R_3 and R_4+R_5 stalked; M_1 free but its origin common with radial branch; origins of M_2 and M_3 in close proximity. Origins of Cu_1 and Cu_2 moved apart, only one A present. In hindwing, Sc forming an anastomose with Rs, both forming a long and slender Sc–R cell; the common branch Sc+Rs connected with M_1 by a short transversal vein; origins of M_2 and M_3 in close proximity; both Cu and two A present. Discal vein slender in both wings.

Wing pattern almost completely reduced, forewing with postmedian line hardly visible. Scale cover thin.

Female genitalia (Fig. 5). Anterior apophyses vestigial; both vaginal plates present; antrum and ductus short; bursa copulatrix bag-shaped, without signum.

Male. Unknown.

So far the genus includes only a single species.

Phantosoma witti sp. nov.

Holotype ♀: "USSR, Turkmenia, Kopet-Dagh Mts., 15 km SE of Nochur, 1300–1400 m, 57°09'E, 38°21'N, 13.–14.XI 1991. N° L49, leg. M.Hreblay & G.Ronkay". Deposited in Museum Witt (Munich).

Description. Female (Fig. 1) with characteristics as given under generic diagnosis above. Wingspan 26 mm, forewing length 14.5 mm. Outer margin of the wings rounded. Forewing olive-green with greenish-yellow spot at R_1 tip; hindwing yellowish-grey, darker towards external area; cilia dark grey on both wings. Body covered with long ash-grey scales sprinkled with less numerous black ones. Anal tuft consisting of dark elongated scales, widened distally and slightly curved. Fore tibia without apophysis (Fig. 3).

Fig. 1. *Phantosoma witti* gen. et sp. nov. holotype ♀: *a* – upperside, *b* – underside.

Female genitalia (Fig. 5). Papillae anales with short setae; apophyses anteriores forked, 7–7.5 times shorter than apophyses posteriores. Antevaginal plate membranous but distinct and presented as a wrinkled lobe; postvaginal plate transverse, strongly sclerotized, U-shaped. Ostium membranous; antrum and ductus short, indistinct, membranous: practically, the ostium is opened immediately into bursa copulatrix; signum absent.

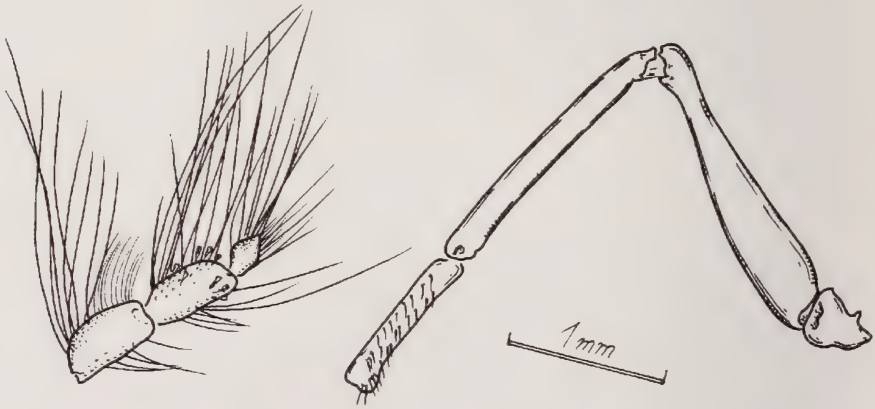
Biology. Late autumn species, admittedly hibernating at the egg stage; the eggs apparently laid in clusters and covered with scales from the female abdominal tuft. The following information about the biology and habitat of this species was given by Gábor Ronkay:

"The new species was found in an uplifted area of the Karayalchi valley, inside the nature reserve, at an elevation of 1300–1400 m above sea level. The relief is rather complex, consisting of rocky slopes, deep gorges and large limestone cliffs. The slopes and the lower parts of the gorges covered with shrubby deciduous forest and smaller grassy patches with low *Cytisus* shrubs.

Two individuals were observed during the day in strong sunshine flying rapidly over the surface, looking like a small yellowish bullet. These specimens were probably males, resembling in flight *Chondrosoma fiduciarium* Anker, 1854 (Geometridae) but even stronger, faster. Due to the surface relief conditions and rapid flight the moths cannot be overtaken at a run.

The single female specimen was picked up at a frosty dawn sitting on grass under a *Cytisus* shrub, having the wings folded over its back like a resting individual of some *Chondrostega* species.

The collecting period was the very late autumn, possibly the last aspect of the year. *Dasypolia, Agrochola, Pachyagrotis* species were observed during that night appearing around the light and the portable light traps".



Figs. 2–3

Fig. 4

Fig. 5

Figs 2–5. *Phantosoma witti* gen. et sp. nov. holotype ♀: 2 – labial palp, 3 – foreleg (tarsus removed), 4 – venation, 5 – female genitalia (ventral and lateral view).

Discussion. The new species is distinct from other lasiocampid moths by several unique characteristics. The presence of the frontal keel (a plesiomorphic character) suggests pupation in a stiff, parchment-like, bag-shaped cocoon, typical for the primitive Lasiocampidae (e.g. *Chondrostega, Trichiura, Poecilocampa, Eriogaster*). At the same time, the moth has no specific teeth or spurs on the fore tibia, suggesting pupation on the ground or on the host plant. Very long flagellar processes on the female antennae are absolutely uncommon for the Lasiocampidae. Venation as a whole is of a primitive type as well as the lack of humeral veins in the costal hindwing area. Conversely, a large Sc–Rs cell is quite untypical for a lasiocampid complex with the venation characteristics pointed above.

When the female genitalia structure is taken into consideration, it becomes possible to suppose the male genitalia to be of a slightly modified type. Among all known Lasiocampidae no genus has forked apophyses in the female genitalia as in this new species.

Thus, the systematic position of this interesting genus within the family Lasiocampidae is not clear. It can be defined more precisely only when males and immature stages will become available for examination. Now this genus is provisionally placed between the so-called "gastropachoid" lasiocampid branch and the subfamily Poecilocampinae.

Acknowledgements

We would like to express our sincere thanks to all persons who helped us in this study. Gábor Ronkay and Márton Hreblay kindly gave this specimen for examination and provided us with the information about its biology. Dr Dieter Stüning (Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn) made photographs of the holotype and assisted us in many other ways. Thomas Witt (Munich) kindly provided an access to his rich collection enabling a comparative analysis; the new species is named in his honour.

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On the ethology and ecology of a small and isolated population of the Dusky Large Blue Butterfly *Glaucopsyche* (*Maculinea*) *nausithous* (Lycaenidae)

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Summary. During a study of a small, relatively isolated population of *Glaucopsyche* (*Maculinea*) *nausithous* (Bergsträsser, 1779), nearly every new adult entering the population was individually marked in summer 1990. Marked individuals were regularly recaptured. The population assessment was nearly complete, as shown by a comparison with estimates based on the Jolly-Seber-model. The average adult residence time was estimated at 2.3 days. Individual observations were made of the diurnal distribution of the following activities: resting, flight, nectaring, oviposition, copulation, and [other] movements. Our results show sex and age specific differences. On the day of marking, which was normally the day of eclosion, all activities were comparatively low. Older individuals of both sexes were generally active for the same amount of time per day, but differed with regard to activity profiles. Males undertook longer flights to search for females within the habitat, while the females flew more often but over much shorter distances, resulting in a shorter total flight time. Instead, females stayed on the flower buds of *Sanguisorba officinalis* — the only larval host plant and main adult nectar source — for much longer, and laid eggs. Females copulate directly after hatching and then immediately start to oviposit.

Zusammenfassung. Eine kleine, isolierte Population von *Glaucopsyche* (*Maculinea*) *nausithous* (Bergsträsser, 1779) wurde im Sommer 1990 nahezu vollständig erfaßt. Aufgrund der intensiv angewendeten Fang-Wiederfang-Methode wurden im Habitat Tiere mit hoher Wahrscheinlichkeit am Tag des Schlüpfens markiert. Immigration konnte weitgehend ausgeschlossen werden. Dadurch kennen wir mit großer Sicherheit das Alter der Tiere, an denen ethologische Messungen durchgeführt wurden. Von Individuen dieser Population liegen zeitliche Messungen der Aktivitäten Ruhen, Fliegen, Saugen, Eierlegen, Kopulieren und Bewegen (Sammelgruppe für weitere Aktivitäten) im Tagesgang vor.

Unsere Ergebnisse zeigen, wie sich die Aktivitäten geschlechtsspezifisch unterscheiden und wie sie sich im Verlauf des Falterlebens verändern. Am Tag der Markierung, der in den allermeisten Fällen mit dem Tag des Schlüpfens zusammenfiel, waren die Aktivitäten vergleichsweise gering. Beide Geschlechter verbrachten ungefähr gleich viel Zeit aktiv, allerdings mit deutlich verschiedenen Schwerpunkten. Während die Männchen längere Suchflüge nach Weibchen im Habitat unternahmen, waren die Flüge der Weibchen zwar zahlenmäßig häufiger, insgesamt verbrachten sie aber deutlich weniger Zeit fliegend. Dafür bewegten sich die Weibchen länger auf den Blütenköpfen der Saug- und Eiablagepflanze *Sanguisorba officinalis* und legten Eier. Weibchen kopulierten unmittelbar nach dem Schlüpfen und begannen direkt danach mit der Eiablage.

Résumé. À l'occasion de l'étude, l'été 1990, d'une petite population relativement isolée de *Glaucopsyche* (*Maculinea*) *nausithous* (Bergsträsser, 1779), presque chaque individu nouveau entrant dans la population a été marqué individuellement, puis régulièrement recapturé. L'évaluation de la population était presque complète, comme l'a montré la comparaison avec le modèle de Jolly-Seber. La moyenne de la durée de séjour des adultes est de 2.3 jours. L'observation des individus est basée sur la répartition des activités diurnes: repos, vol, alimentation, copulation, oviposition et autres. Nos résultats montrent des différences selon le sexe et l'âge. Le jour du marquage, qui est normalement celui de l'émergence, toutes les activités sont comparativement réduites. Les vieux individus des deux sexes sont généralement actifs pour la même durée chaque jour, mais diffèrent par leurs profils d'activités. Les mâles passent de longues périodes en vol à la recherche des femelles dans le milieu, alors que les femelles volent moins souvent et sur des distances plus réduites, résultant donc en une durée de vol total plus courte pour celles-ci. À la place, les femelles se reposent sur les inflorescences de *Sanguisorba officinalis* — la seule plante-hôte des chenilles et la principale source de nectar — pour des durées plus longues et déposent leurs œufs. Les femelles copulent immédiatement après l'émergence et commencent la ponte des œufs juste après.

Key words: Lepidoptera, Lycaenidae, *Glaucopsyche* (*Maculinea*) *nausithous*, diurnal behaviour, age dependent behaviour, etho-chronogramme, population structure, dispersal, residence time, MRR-study, Rhineland-Palatinate, S. Germany.

1. Introduction

The ecology of the Dusky Large Blue *Glaucopsyche* (*Maculinea*) *nausithous* (Bergsträsser, 1779) has been quite well studied. This is due mainly to its high level of vulnerability as expressed in Red Lists (for Germany e.g. Pretscher, 1998) and the annexes of the Habitat Directive of the EU and in the Bern Convention (Gruttke, 1996; van Helsdingen *et al.*, 1997), and also to its fascinating *Maculinea*-type ecology.

The present study aims to improve knowledge on the adult ethology and population ecology of the species with special respect

to small and isolated populations. An example of such a population was studied in 1990 throughout the flight period. As the individuals of *G. nausithous* fly slowly compared to other butterfly species, they are easily followed. The species may reach high densities in its habitats, and is closely associated with its principal nectar source and larval host plant *Sanguisorba officinalis*. For a mark-release-recapture study, it is therefore sufficient to search for patches with flowering plants.

2. Materials and methods

2.1. **The species *Glaucopsyche nausithous*.** *G. nausithous* is univoltine. Eggs are exclusively deposited on *Sanguisorba officinalis*, where the first three larval instars develop. Hereafter the caterpillar reaches the ground to be adopted by ants of *Myrmica rubra* L., the only known host ant of the butterfly. Within the ant nest the larvae live predaciously and later pupate. On average, 2.5 pupae are found in one nest. This and further recent information on the ecology of the species are to be found e.g. in SBN (1991), Elfferich (1998), Thomas *et al.* (1998), Thomas & Elmes (1998) and Wynhoff (1998).

2.2. **Study sites.** The study was conducted on a ca. 2000 m^2 fallow grassland within the Mooswieser Tal (Mooswieser Valley, site M hereafter) south of the city of Kaiserslautern, between the settlements Aschbacherhof and Weiherfelderhof at an elevation of 300 m above sea level. The site was characterised by a high density stand of *Sanguisorba officinalis*, unlike the meadows located both to the East and to the West of the site. The northern and southern limits of the site are dense pine forests of the Pfälzerwald (Palatine Forest). Thus, the area of suitable habitat was relatively isolated. The only possible immigration of *G. nausithous* from its immediate surroundings was from the margins of meadows lying west of the study site, where some *S. officinalis* plants flowered during the flight period and where some individuals of *G. nausithous* were found. No host plant was found to the East of the site. This relatively isolated site was chosen for the study because it seemed possible to mark a high percentage of all individuals at the day of emergence with the manpower available and to identify their age for the behavioural analysis.

The site was divided into two parts. The northern sub-area of the Aschbach (a little creek) was drier with *Sanguisorba officinalis* dominating the vegetation, while the wetter sub-area south of the Aschbach held high densities of *Lythrum salicaria* L. and sedges, but only occasional exposed *S. officinalis* plants.

An additional site Hagelgrund (in the Eselsbachtal, site H hereafter), north of the city of Kaiserslautern, was also studied. This was used mainly to test our method of using small portable computers (see 2.5). In some cases we later used data obtained from Hagelgrund to enlarge the basis of our study (see Tab. 1 below).

There the first *G. nausithous* could be observed on 13 July, one day before the first male on site M. As the next observations at site M have only been made from 17 July onwards, we made some more studies at site H until that day.

2.3. **Marking.** Adult butterflies were caught at rest with our fingers. A waterproof pen was then used to write numbers on the underside of both hindwings so that the individual could be easily recognised while following it. The site in the Mooswieser Tal was visited almost daily during the flight period (see Fig. 1), and all unmarked individuals encountered were marked and previously marked specimens were recorded.

The *S. officinalis* stands of the more western meadow margins were visited less often. All newly encountered individuals were also marked and we searched for marked adults which might have emigrated from our main study site.

2.4. **Estimation of population size**. One way to quantify the size of a population is to sum the minimum number alive (MNA). As the name implies, this gives the minimum number of animals that are present in the population at one particular time. To reach that number, the number of marked individuals registered (or marked) in the particular time step (e.g. day) and the number of individuals marked before that time step and recaptured again after the time step, but not registered at the time step itself, are added. Individuals that have left the population in the meantime, as well as those which were overlooked at the time step and were not re-sighted later (because they have died, emigrated or been overlooked repeatedly) do not contribute to the MNA of a particular time step. The total number of individuals present (for a particular time step,

like one day or the whole time of a species activity, e.g. 5 weeks) must therefore be at least as high as this minimal number alive, but normally is much higher. As the number directly depends upon the mark recapture efforts invested and the size of the population, its application is more appropriate in small populations of animals with a comparatively high recapture rate, but it cannot be reliably used to compare different populations (Settele *et al.*, 2000).

In order to compare population sizes, the Jolly-Seber method might be suitable to get a first rough idea on daily as well as total population sizes (see e.g. Seber, 1982, and Pollock *et al.*, 1990, for details). For the latter one may e.g. sum up the *B*-values (i.e. the individuals added to the population between two population estimates) resulting from the Jolly-Seber model (see Settele *et al.*, 2000 for an example and further details with respect to butterflies). However, one has to keep in mind, that Jolly-Seber estimates are not very robust with respect to population size.

Table 1. Origin of additional data for the diurnal etho-chronogrammes (Figs 3, 4), which served as a basis for the computing of the age dependent etho-chronogramme (Fig. 5) (M – Mooswieser Tal (Aschbachtal), H – Hagelgrund (Eselsbachtal)).

Completed classes		**Origin of data**	
Age class	**Period**	♂♂	♀♀
0	before 10:50	♂♂ 1–2, before 10:50, M	♀♀ 1–2, before 10:50, M
	10:50–11:40	♂♂ 0, 10:50–11:40, M+H	♀♀ 0, 10:50–11:40, M+H
	11:40–12:30	♂♂ 0, 11:40–12:30, M+H	
	15:50–16:40	♂♂ 0, 15:50–16:40, M+H	
3–10	15:50–16:40		♀♀ 1–2, 15:50–16:40, M
	16:40–17:30		♀♀ 1–2, 16:40–17:30, M
	after 17:30		♀♀ 1–2, after 17:30, M

Strictly spoken, only for the age class 1–2 days a complete diurnal etho-chronogramme could be constructed. Thus, in some cases additional data have been used from the site Hagelgrund to construct an age dependent etho-chronogramme out of the diurnal etho-chronogramme. Data of the class 1–2 day old butterflies have been used, if still the pooled data from both sites (M and H) have not been sufficient. There have been no data of both sexes of age class 0 for the daily time before 10:50 h. Therefore data of 1–2 day old butterflies have been used. For the period 10:50 h – 11:40 h of the 0 day old butterflies of both sexes the data of M and H had to be combined to achieve enough observation time. For the males it also has been necessary to use data from H for the other age classes. For the 3–10 day old females data of 1–2 day old females have completely been taken for the last 3 time classes in order not to miss the age dependent etho-chronogramme.

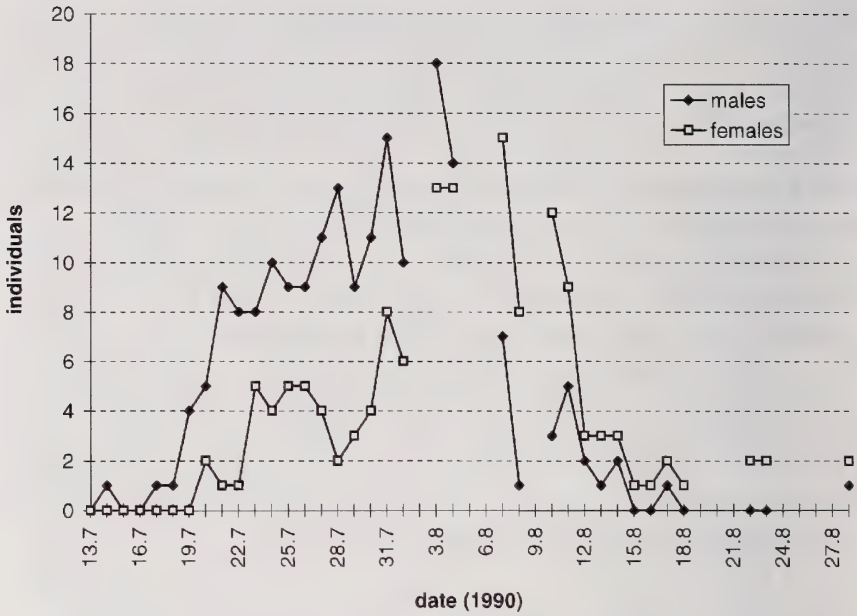
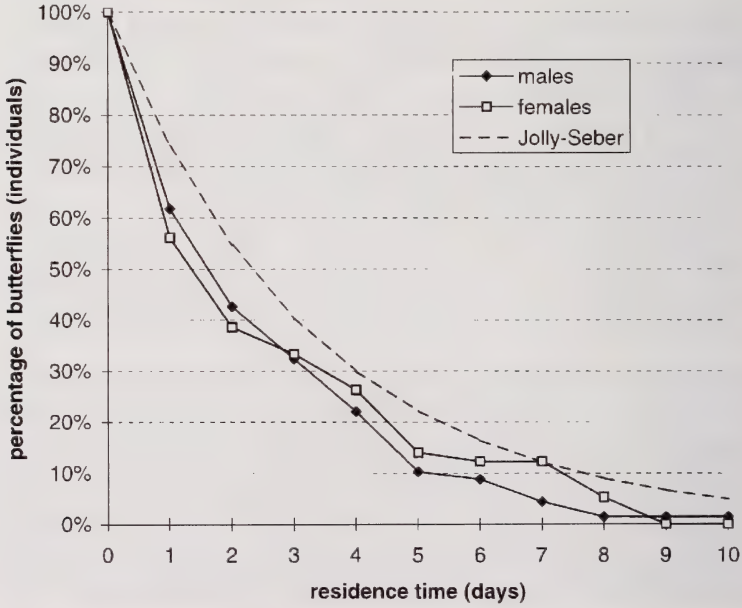


Fig. 1. Minimum daily population sizes (minimal number alive; for days without observations no entries have been made).



2.5. **Ethological observations.**

2.5.1. **Definitions**. The activities flight, moving, nectaring, oviposition, copulation, and resting were recorded separately for each individual. Registration was performed with small portable computers, using a programme especially written for our study. The observer randomly chose a butterfly and entered its number into the computer. For each activity an abbreviation, consisting of one letter, was used. At the beginning of each activity the observer pressed the relevant letter, which was saved together with the time. The duration of one activity was obtained from the difference between the start of the present activity and the start of the next one.

The activity moving consisted of diverse activities, which were registered separately in the field, but have been lumped here. These activities were: walking, turning (e.g. females turning on the flower heads to look for suitable egg laying niches), cleaning, fluttering while sitting, and the characteristic lycaenid behaviour of parallel up and down movement of the closed wings. Thus, turning when looking for a suitable egg laying niche was not counted as egg laying behaviour, as it could not be clearly separated from nectaring. A female looking for an egg laying locality and turning therefore on the flower, every once in a while is nectaring. Oviposition was defined as the time while the butterfly has put its abdominal tip between individual flowers of a flower head. Sometimes females rapidly changed between different single flowers, performing abdominal bends and touching the surface of the flower head with the abdominal tip. Each of these events was regarded as one oviposition behaviour (*sensu* Figurny & Woyciechowski, 1998).

←

Fig. 2. Relative observed residence time and residence time according to the Jolly-Seber-method. There are hardly any differences between males and females. The residence probability within the population is 74% for each age, according to Jolly-Seber. This means that 74% of all individuals reside for 1 day, 55% for 2 days, ... 5% for 10 days. This exponential dependence only is valid if residence probability is age independent. As the observed number of residing individuals decreases exponentially as well, age independence can be assumed. The figure proves the intensive assessment of the population, because otherwise the Jolly-Seber-curve would be clearly above the observed values.

Nectaring was scored as the time when the butterfly put its proboscis into the flowers or when it rapidly moved from one flower to the next looking for the best nectar source.

About 150 hours of observations were registered on our portable computers, consisting of about 11,000 events.

2.5.2. **Analysis of behavioural observations**

2.5.2.1. **Procedure and classification**. The data have been analysed so that on the one hand the diurnal distribution of the single activities can be described (diurnal etho-chronogramme), and, on the other to quantify how the sexes differ in their behaviour and how behaviour changes with age (age dependent etho-chronogramme).

The data were therefore classified as follows:

- sex: male, female
- age: 0 days, 1–2 days, 3–10 days
- time intervals: 10:00–10:50, 10:50–11:40 ... 17:30–18:20
- activities: flight, moving, nectaring, egg laying, copulation, resting

The classes were kept as small as possible. Even so, the activity copulation caused problems in analysis, as there have been relatively few events lasting for relatively long time.

This procedure resulted in every day consisting of 10 classes of 50 minutes each. The total observation time within each class (i.e. the total of all single events) had a length of at least 3,000 seconds (= 50 min.). However, because few activities occurred early and late in the day, the first class summarised all results before 10:50 Central European Summer Time (= GMT or 9:20 local time), starting with the first observations at around 9:30; the last class summarised results after 17:30 (GMT), with last observations around 19:30. Most data of the first class are indeed from 10:00 – 10:50 and of the last class from 17:30 – 18:20.

Sexes were treated separately and three age classes formed (see also results) with an approximately even distribution of total observation time. This resulted in the age classes 0, 1–2, and 3–10 days.

2.5.2.2. **Diurnal Etho-Chronogrammes** (Figs 3, 4). Observation time (t) of one activity was summarised within one class (e.g.: males, age: 1–2 days; time: 10:50–11:40):

$$\Sigma\, t_{\text{flight, 1-2days, 10:50-11:40, all males}} = t_{\text{flight, 1-2days, 10:50-11:40, male 1}} + t_{\text{flight, 1-2days, 10:50-11:40, male 2}} + \ldots + t_{\text{flight, 1-2days, 10:50-11:40, male n}} \quad (1)$$

Then the relative proportion (τ) of one activity compared to the total duration of all activities was calculated. This was done as in the following example for flight of the 1–2 day old males for the period 10:50–11:40:

$$\tau_{\text{flight, 1-2 days, 10:50-11:40, all males}} = \Sigma\, t_{\text{flight, 1-2 days, 10:50-11:40, all males}} / (\Sigma\, t_{\text{flight, 1-2 days, 10:50-11:40, all males}} + \Sigma\, t_{\text{moving, 1-2 days, 10:50-11:40, all males}} + \Sigma\, t_{\text{nectaring, 1-2 days, 10:50-11:40, all males}} + \Sigma\, t_{\text{copulation, 1-2 days, 10:50-11:40, all males}} + \Sigma\, t_{\text{resting, 1-2 days, 10:50-11:40, all males}}) \quad (2)$$

Figs 3 and 4 show the diurnal etho-chronogrammes of 1–2 day old males and females. Within the other age classes, data were insufficient to provide a complete diurnal distribution. Nevertheless, diurnal etho-chronogrammes were computed as these were needed in the age dependent etho-chronogrammes.

2.5.2.3. **Age dependent Etho-Chronogrammes** (Fig. 5). The age dependent etho-chronogrammes show how the distribution of activities changes with increasing age and how the sexes differ. Absolute values (in minutes) were calculated from the relative proportions of the time classes of the diurnal etho-chronogrammes. In other words, we calculated how long a virtual butterfly of a certain age class performed each activity during a whole day. The computation is shown for the total flight time of 1–2 day old male butterflies:

$$\Sigma\, t_{\text{flight, 1-2days, all males}} = (\tau_{\text{flight, 1-2 days, before 10:50, al males}} + \tau_{\text{flight, 1-2 days, 10:50-11:40, all males}} + \ldots + \tau_{\text{flight, 1-2 days, after 17:30, all males}}) * 50 \text{ min} \quad (3)$$

In some classes the data were insufficient (observation time in the 50 minute class was less than 3,000 seconds) to reach a balanced distribution of activity. In these cases, additional data were included from a nearby locality (H – Hagelgrund, see chapter 2.2). Even so, data for the last three time classes of 3–10 day old females were still too few (see Tab. 1). Since the values for the first six time classes (10:50–15:50) of 3–10 day-old animals were very similar to those for the diurnal etho-chronogrammes of 1–2 day old insects, we assumed that the values of the three remaining classes were only slightly different from the values of 1–2 day old females. Although this is not entirely correct, for the sake of obtaining a

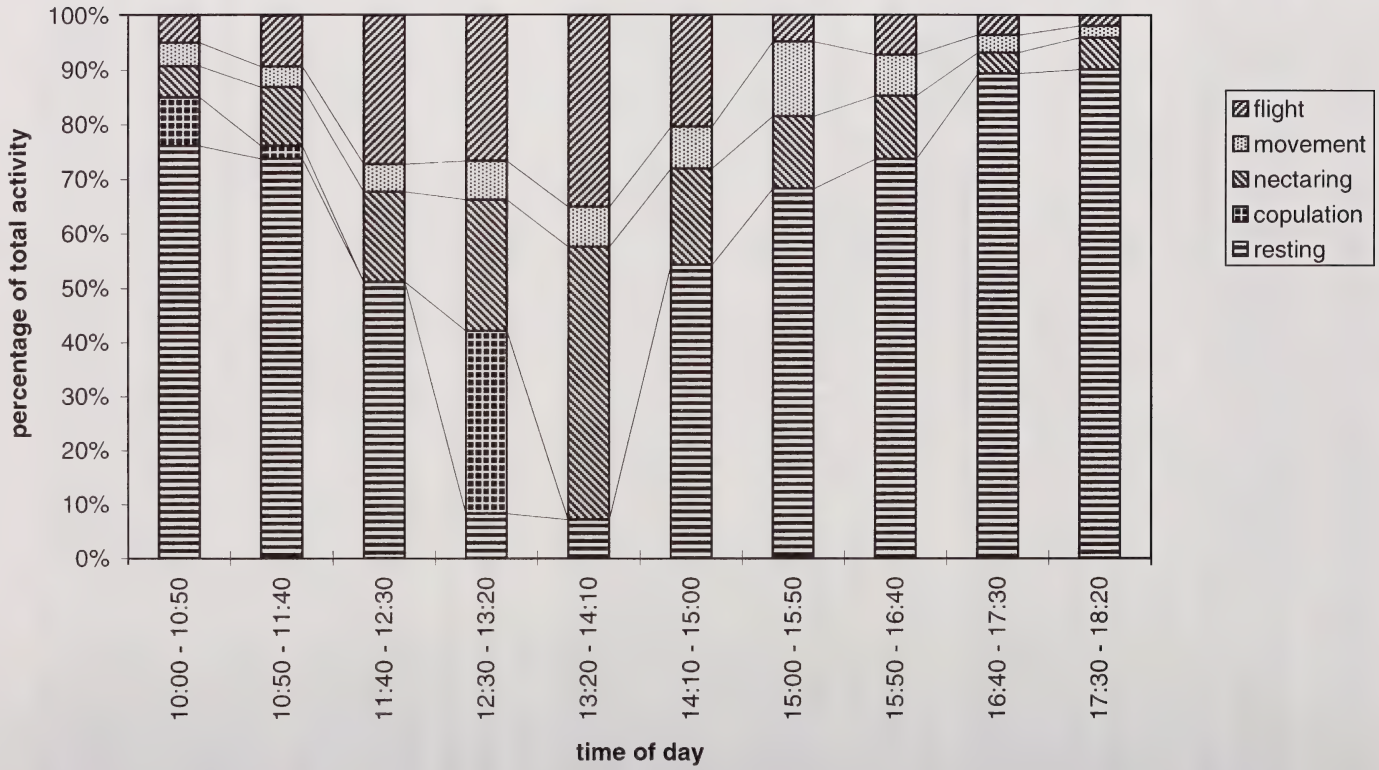


Fig. 3. Diurnal distribution of activities (diurnal etho-chronogramme) of 1–2 days old males (for computation compare chapter 2.5.1).

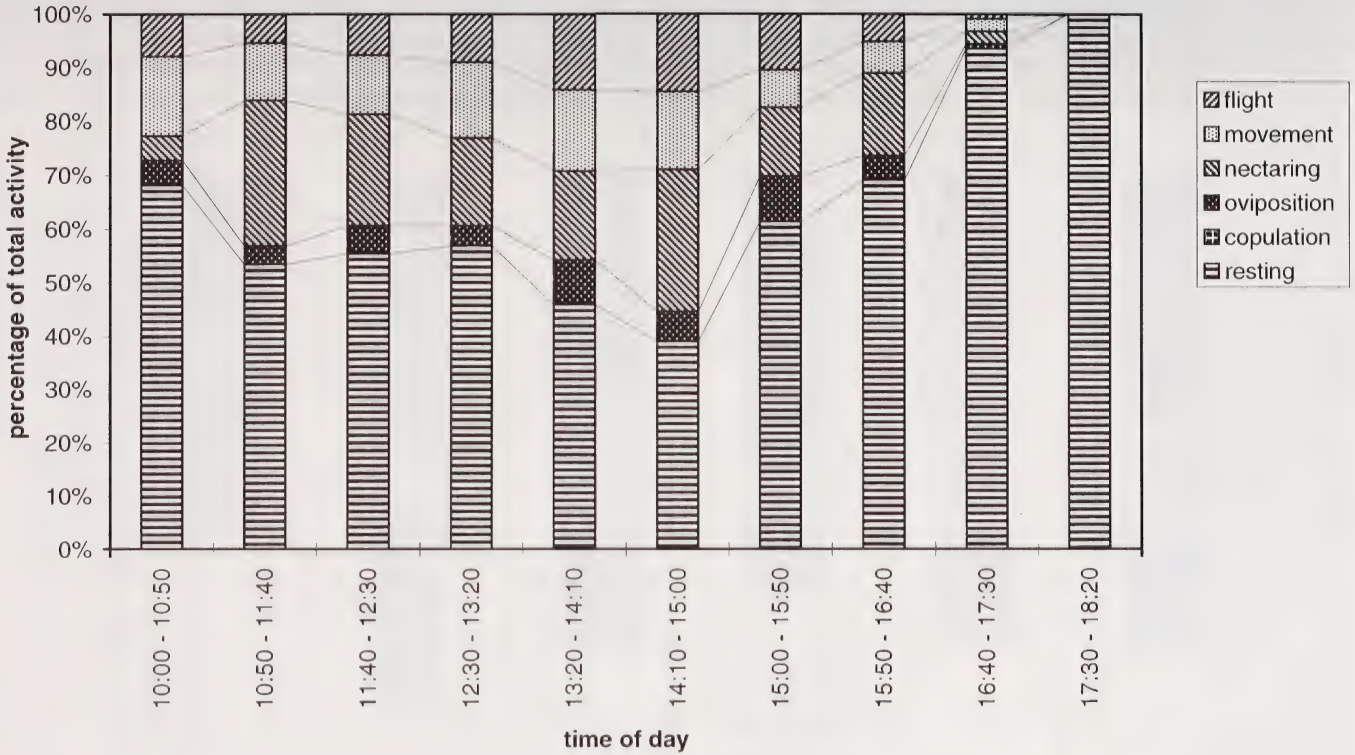


Fig. 4. Diurnal distribution of activities (diurnal etho-chronogramme) of 1–2 days old females (for computation compare chapter 2.5.1). In both sexes (Figs 3, 4), the maximum of activity of 1–2 days old individuals is around noon time.

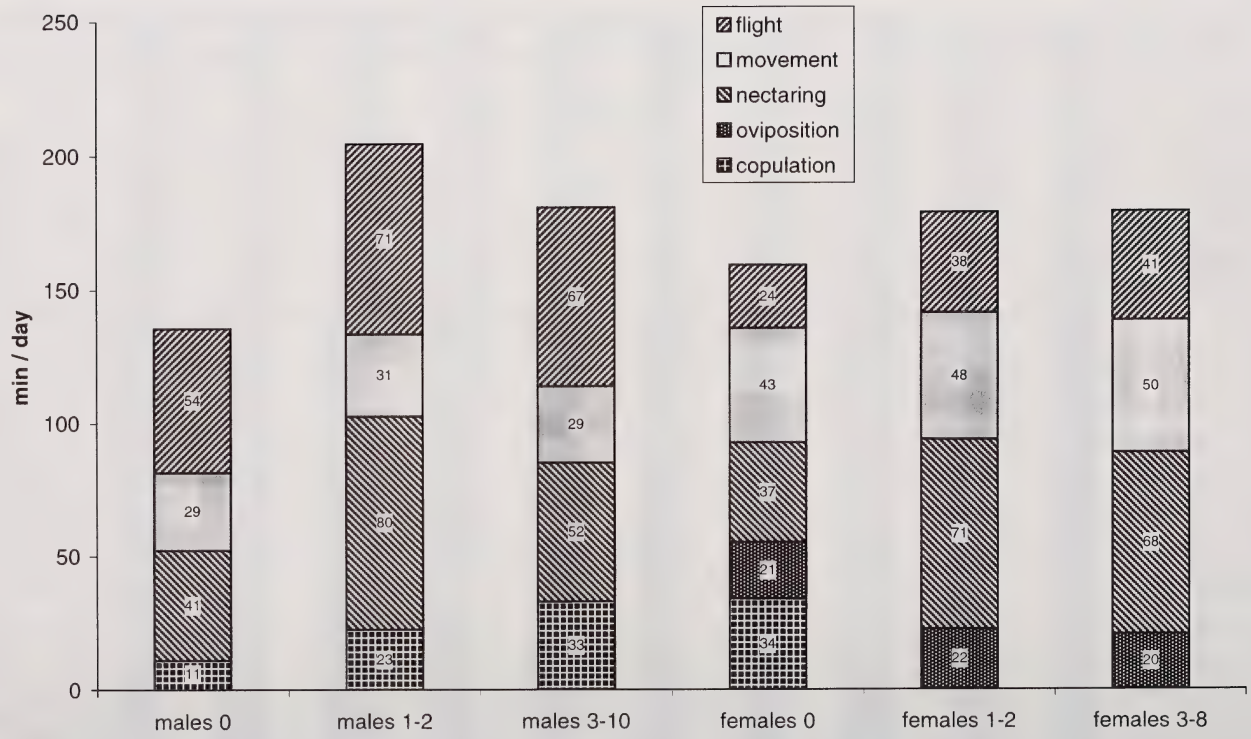


Fig. 5. Age dependent distribution of different types of activities (age dependent etho-chronogramme). 0 day old individuals are less active than older ones. Whether this is a handling effect or natural indolence is unclear. The figure shows, that both sexes are active for approx. the same time, however in different ways. Uncertainty referring to time consumed for copulation is large. Copulation events observed are only a few, which however last rather long compared to other activities. Thus, an over- or underestimation can not be excluded.

complete picture of the age dependent etho-chronogrammes we decided to include values of 1–2 day old females for computing values of 3–10 day old females. In the first class (before 10:50) of the 0 day old insects, no data were available, as the insects had just been marked. To achieve a complete picture, the values of the 1–2 day old butterflies were also used in the first time class of the 0 day old ones.

For an overview of the manipulations performed for the computation of the age dependent etho-chronogrammes see Table 1.

2.6. **Discussion of methodology**

2.6.1. **Handling and behaviour.** Morton (1984) states that handling in some butterfly species can affect recapture probability. He also mentions that different species react quite differently in this respect. However, for *G. nausithous* there is no indication for a handling effect. For example, neither Geißler-Strobel (2000) nor Binzenhöfer & Settele (2000) detected any behavioural change after handling this species; some individuals even copulated immediately after the handling and females continued to lay eggs (Binzenhöfer & Settele, 2000).

2.6.2. **Observation and behaviour.** The presence of (generally) three observers on a relatively small site might have influenced adult behaviour, especially flight activity and emigration. However, our observations suggest that the insects were not affected. We observed the butterflies from an average distance of about 2 meters, where they did not show any reaction, although one can approach as close as few decimetres without noticeably affecting behaviour. Although the *S. officinalis* plants were occasionally shaken, this was greatly outnumbered by the number of natural disturbance events e.g. by males performing courtship behaviour or by other insects.

2.6.3. **Limits of observation time due to methodological constraints.** The insects were observed for as long as possible. However, we sometimes lost track of flying adults, especially males, leading to an underestimate of this activity.

Table 2: Residence times of *G. nausithous* on the main research site (n – total number of butterflies marked)

Number of days	0	1	2	3	4	5	6	7	8	9	10
Males (n = 68)	26	13	7	7	8	1	3	2	0	0	1
Females (n = 57)	25	10	3	4	7	1	0	4	3	0	0

Table 3. Average residence time of the *Maculinea* species.

Species	**Sex**	**Average residence time [days]**	**Reference**
Glaucopsyche (*Maculinea*) *nausithous*	♂	1.9	present paper[a]
G. (*M.*) *nausithous*	♀	2.0	present paper[a]
G. (*M.*) *nausithous*	♂ ♀	2.3	present paper[b]
G. (*M.*) *nausithous*	♂	5.4	Geißler-Strobel (2000)[c]
G. (*M.*) *nausithous*	♀	3.3	Geißler-Strobel (2000)[c]
G. (*M.*) *nausithous*	♂	1.3	Laux (1995)[b]
G. (*M.*) *nausithous*	♀	0.8	Laux (1995)[b]
G. (*M.*) *nausithous*	♂	ca. 4	Seiler (1991)[a,c]
G. (*M.*) *nausithous*	♀	ca. 3	Seiler (1991)[a,c]
G. (*M.*) *nausithous*	♂ ♀	ca. 0.7–2.3	Wynhoff (1998)[c,d]
G. (*M.*) *teleius* (Bergsträsser)	♂ ♀	0.7	Laux (1995)[b]
G. (*M.*) *teleius*	♂ ♀	ca. 0.3–2.8	Wynhoff (1998)[c,d]
G. (*M.*) *arion* (L.)	♂ ♀	1.8	Pauler *et al.* (1995)[a,c]
G. (*M.*) *rebeli* (Hirschke)	♂	1.8	Kockelke *et al.* (1994)[a,c]
G. (*M.*) *rebeli* (Hirschke)	♀	2.5	Kockelke *et al.* (1994)[a,c]

[a] Average residence time: difference between first and last sighting.
[b] Average residence time based on Jolly-Seber estimates.
[c] The authors mention one day more, as they regard an individual at the day of first sight as one day old already. Thus the data have been corrected by –1 for this contribution, to make comparison of data possible.
[d] data from 1991 until 1996.

Table 4. Number of eggs laid per female per day, based on mean daily behavioural profiles.

Age class	**Number of eggs laid (estimated*)**
0 day	80
1–2 days	94
3–8 days	81

* according to our estimate; we assume that in about 95% of all oviposition behaviour events eggs have really been laid (compare text).

Table 5. Average number of flights and average flight duration of 1–2 days old males and females of *Glaucopsyche nausithous* during one day of observation (10:00 to 18:20 h Central European Summer Time).

Sex	events/day/individual	duration/day/individual	duration/event
♂	161	71 min	26 sec
♀	223	38 min	10 sec

3. Population ecological results and their discussion

3.1. **Population dynamics.** The flight period of the population lasted from 13 July until 28 August 1990 (at the site Mooswieser Tal). Weather conditions were favourable for nearly the whole period, with the exception of two rainy days and one further day with maximum temperatures below 20°C. Thus, periods of reduced abundance were neither expected nor observed during the course of the population curve (based on the minimal number alive; see Fig. 1).

The proterandric phenology of *G. nausithous* is clearly visible in Fig. 1. For example, the date when half the males in the whole population had been observed (29 July) is clearly (5 days) earlier than the date for half the females (3 August). In *G. nausithous*, proterandry has been observed in many instances (Geißler-Strobel, 2000; Garbe, 1991; Laux, 1995) and is a common phenomenon in other butterfly species (see e.g. Wiklund & Fagerström, 1977).

Our population reached its maximum on 3 August 1990, with a minimum number (see chapter 2.4) of 18 males and 13 females (see Fig. 1). This was also the day of maximum male numbers, while that of females (with 15 individuals) occurred on 7 August. As the population curve is asymmetric (left sided), the date at which half of the total annual population appeared is earlier (29 July for males and 3 August for females, see above).

3.2. **Population size.** In total, 68 males and 57 females were marked on the main site. A further 18 males and 20 females were marked elsewhere, of which 28 butterflies were encountered near the settlement Alte Schmelz, >1.5 km away. None of these marked specimens were found entering the main site, nor was any specimen found outside after being marked on the main site.

Due to the intensive effort, nearly every adult entering the population was marked on the day it emerged. Thus, an estimate based on the daily estimates and a summation of the *B*-values (i.e. the individuals added to the population between two population estimates) of the Jolly-Seber model (see e.g. Seber, 1982, and Settele *et al.*, 2000) resulted in 122 specimens, three specimens less than the 125 marked individuals.

The use of this method was not ideal for this study because the small population size and short residence time of individuals resulted in few recaptures on some days. Thus, for a more thorough statistical analysis, only the central 18 days of field assessment could be used (omitting the first 5 and the last 7 days). For this period the total population size is 119, with a 90% confidence interval of +/– 16 (and a MNA of 112; resulting in a population size between 112 and 135; calculation according to Settele *et al.*, 2000:181, Tab. 5.14a; but see "http://www.ufz.de/spb/nat/settele/tagfalter.html" for corrections).

Estimates of total population size support our notion that the population was almost completely assessed on the main site. In contrast, the number of individuals outside the main site was undoubtedly larger than the marked 38 specimens (due to low intensity of field work and thus low numbers of marked and recaptured specimens Jolly-Seber estimates can not be performed). But, as no individual among those marked outside the main site was recaptured within the site and vice versa, we assume that the number of individuals immigrating into the site must have been very low. Additionally, none of the specimens freshly marked on the site showed obvious signs of extensive previous flight activity (like loss of scales or fringed wing margins), which would have suggested it was an immigrant.

3.3. **Dispersal and isolation of the population.** Our assumption of low emigration and immigration is consistent with the statements of low mobility of the species by Bink (1992) or Weidemann (1995). New studies however reveal that it is much less sedentary (Settele *et al.*, 1996). The longest dispersal distance observed so far is 5100 m (Binzenhöfer & Settele, 2000). Detailed studies on the species' mobility (e.g. Geißler & Settele, 1990; Binzenhöfer & Settele, 2000) have mainly been performed in landscapes with numerous local populations and rather large habitat patches. There-

fore these distances might be due to mobility within habitats or between habitats, using stepping stones (e.g. singular *Sanguisorba* stands) in the latter case. The low density of habitats in the study region and the isolated situation of the study site (due to a large portion of surrounding forests) makes it less probable, that butterflies immigrate from other populations in large numbers. As in the study of Laux (1995), high recapture rates indicate comparatively sedentary behaviour in these types of environments. Some emigration as well as immigration can of course never be excluded.

3.4. **Residence time**. It follows from 3.3 that the vast majority of butterflies must have hatched from the site itself. We can also be confident that the majority of animals has been marked on the day of hatching, so their date of eclosion is known. Consequently, it was generally possible to identify the exact age of a butterfly at each activity or recapture.

The average residence time was estimated based on Jolly-Seber (Seber, 1982; Pollock *et al.*, 1990) estimates of the population size and residence rate (φ). The average residence rate equals $-(\ln\varphi)^{-1}$ and resulted in a value of 0.74, which is a weighted average (with respect to the daily populations size), covering the whole flight period. Because of the small population size, both sexes were combined, which does not introduce bias so long as both sexes have similar recapture rates, as here (61.8% for males, 56.1% for females; compare Tab. 2, which also gives an indication for the frequency of capture as assessment was made nearly every day and the z-values for the Jolly-Seber-estimate are mostly 0).

The residence time of the different age classes (in days) can thus be expressed as function $f(age) = 0.74^{age}$ (Fig. 2). The average residence time is the average time one individual spends in the population or the time when the population is reduced by 50%, i.e. $f(age) = 0.5$. In our case, the average residence time was 2.3 days, which is only slightly higher than the average value resulting from the difference between the day of marking and the day of last observation of all butterflies (2.0; compare Fig. 2 and Tabs 2, 3). This is a function of the comprehensiveness of our observations.

As our population has both been studied intensively and experienced low losses due to emigration, we can regard the average residence time as a good approximation of the average life time. If we

additionally regard the average residence times of other authors (see Tab. 3), we can state that the longevity of adult *G. nausithous* is rather short compared to other butterfly species (compare e.g. Scott, 1973). Looking at other *Maculinea* species (Tab. 3), this seems to be typical for the whole taxon (but not exclusive, as shown for many other temperate-zone Lycaenidae: Väisänen *et al.*, 1994; Arnold, 1983; Warren 1992).

The observed age independent survival probability of the species also indicates that the butterflies reach their potential physiological age only in few exceptional cases, as in all free living organisms. On our study site we had 6 cases of spider casualties (web or crab spiders). 2 butterflies were killed by cars on a nearby road. One specimen just died and dropped off a *Sanguisorba* stem for no obvious reason. Despite our intensive study, we thus know the reasons for the death of only 8 out of 125 marked specimens. We only can assume the high activity of potential predators (high densities of damselflies, dragonflies and birds along the nearby creek; further spiders with undiscovered prey, or nocturnal predators).

3.5. **Availability of *Sanguisorba* flower heads as nectar sources.** The number of flower heads was partly counted. Stands with counted flower heads were used to estimate further *Sanguisorba* stands by eye. The number of heads increased from ca. 400 in the early flight days to ca. 1600 towards the end of the emergence. The number of flower heads must have been sufficient throughout the flight period, as it probably has only to provide the carbohydrates needed for flight, as is the case with most short lived butterflies, which normally acquire the resources needed to develop eggs during the earlier larval stage (capital reserves, compare Sibly & Calow, 1984, 1986).

3.6. **Availability of oviposition sites and emigration.** Eggs are exclusively laid on *Sanguisorba officinalis*. As shown by Thomas (1984) and intensively studied by Figurny & Woyciechowski (1998), closed or only slightly opened flower heads are preferred. Nearly all flower heads on the study site were in the preferred stage. The total number of flower heads then steadily increased, reaching a maximum of about 1600 towards the end of the flight period, although the number of closed or only slightly opened ones was lower than in the beginning.

Based on our behaviour data (see below) we tried to estimate the average number of eggs laid per female per day. Laux (1995) stated, that in *G. nausithous* only an egg laying behaviour that lasts at least 3 seconds results in an egg being laid. In most cases she registered one egg per egg laying event. In our study, in 95% of all cases, egg laying behaviour lasted at least 3 seconds. In fact, only in 22 of 53 egg laying events (42%) observed by Laux (1995) were eggs actually laid. However, we were unaware of this observation when we collected our data, nor did we interrupt the time registration when a female quickly inserted her abdomen between single flowers, which led to the high value of 95%. On the other hand, this presumed overestimate will be compensated for, as several egg laying behaviours sensu Laux (1995) have been regarded as only one. This has to be kept in mind when interpreting the following rough estimates of eggs laid.

(Precise empirical data on egg production and its dynamics are lacking for all *Maculinea* species. Such data are urgently needed in order to evaluate the usefulness of published estimates, like in Bink (1992), as well as for parameterizing models.)

According to our estimates, just under 10,000 eggs were laid on our study site (assuming 60 females with an average life expectancy of 2 days and an egg production of 85 per day; see Tab. 4). The number of *Sanguisorba* flower heads was around 1600 at the end of the flight period, many of which were not available during the peak of population density at the main flight period. Other flower heads never reached the size necessary for *G. nausithous* females to lay eggs on (according to Figurny & Woyciechowski, 1998, the flower head has to have a length of at least about 6.5 mm). If we assume that about three quarters of all heads were used for oviposition, we would have 1200 flower heads used. This would give an average of 8 eggs per flower head. This is of the same order of density reported by Fiedler (1990), who found an average of 7.65 eggs per head in habitats with high density of butterflies but relatively few *Sanguisorba* plants (with a maximum of more than 20 per head).

Fiedler (1990) found that more than 3 larvae seldom survived in one flower head. Larger numbers of eggs per flower head thus have low survival probability, which means that the number of egg-lay-

ing possibilities may limit population size. *G. nausithous*, according to Figurny & Woyciechowski (1998), does not seem to be able to recognise whether a flower head already contains eggs. Hence, the increased tendency for dispersal within the second half of the flight period, which was observed by Garbe (1991), may be stimulated by decreasing number of flower heads available in a suitable stage. As in our study, the number of preferred non-flowering flower heads (compare Figurny & Woyciechowski, 1998) was (even absolutely, not only relatively) decreasing towards the end of the phenology, in spite of an increasing total number of flower heads, we could also imagine such effects to be of relevance for our population. However, due to the small number of marked butterflies, we have no proof for differences in residence times during the phenology of the species. This merits further study.

4. Results and discussion of behavioural observations

4.1. **Preconditions for the interpretation of behavioural observations.** As the population results show, most adults were marked on the day of hatching. Thus we could identify the age of the butterfly at a later recapture. We considered that there was no lack of food, resting sites or similar resources. We assume that the flower heads often receive more eggs than they can support, as the females cannot identify whether a head is already occupied. Thus the behaviour of the adults would not have been affected.

4.2. **Handling.** Our results show that <1 day-old individuals are less active than older ones (Fig. 5). For the age class 3–10 days (diagrams not shown) the diurnal etho-chronogrammes for both sexes are very similar to those of the 1–2 days old adults (Figs 3, 4). In contrast, the results for age class 0 (diagrams not shown) are very variable and show no clear maximum of activity around noon. As stated, Binzenhöfer & Settele (2000) found no handling effect for this species (see 2.6.1). Our data show that insects are less active on the day of marking than on other days. This might be explained as natural for the species or as a handling artefact. However, as males and females have been affected in a very similar way, we regard the comparisons between both sexes as justified.

4.3. **Copulation and oviposition.** For the 1–2 day-old males, the diurnal distribution of activities is strongly influenced by the

occurrence of copulations (see Fig. 3). Although we observed only 2 copulations, these have a strong influence because of their long duration. The females of this age class normally had no copulations (Fig. 4). In total, three copulations were observed for their entire length, which lasted between 24 and 34 minutes.

If observations from Eselsbachtal are included, we know the age of 12 females and 10 males of a total of 13 copulating couples. Females probably copulate only once, in all but one observed case on the day of emergence. Of the 13 copulations, 11 were in the morning or early afternoon (until ca. 14:30 h). Only twice was copulation observed after 17:00 h. These results indicate that females copulate as early as possible. Only in one female at Eselsbachtal was copulation observed on the next morning after the day of marking (but then earlier than all other copulations with newly hatched females; at 10:27 h, when the couple was sighted, copulation was already going on).

The 10 males of known age at copulation were up to 7 days old. The sexual activity of males seems to last for their whole lifetime. Two of the males were observed copulating twice. According to SBN (1991), older *Maculinea* males are more often involved in copulations than younger ones, which also fits to the observed lower activity of 0 day adults in our study. And if males mate less often when they are young, it would not be surprising as they first have to reach sexual maturity (sclerotization of genitalia, maturation of testes), which may take longer in males of protandrous species (own unpubl. data; Fiedler, pers. comm.).

In one case, egg laying behaviour was observed as soon as 17 seconds after the end of copulation, although we did not see whether an egg was actually laid. In a second case, a female did not lay for 35 minutes, and was then lost from sight; however, after 1 hour and 44 minutes, the same female was resighted laying eggs. The copulation of females immediately after eclosion and mating may be seen as consequence of their short residence time. Before leaving the population (due to death or emigration) they leave as many eggs as possible in their habitat of origin. According to Fiedler (pers. comm.) this has to be regarded as a remarkable exception from all other Polyommatinae lycaenids, where noticeable egg production starts about 1–2 days after mating and reaches its peak another 1–2 days later.

4.4. **Flight.** Flight in both sexes peaked shortly after 12:00 h local time (i.e. 13:30 h central European summer time) when the sun was already in its highest position, but temperature had not yet reached its maximum (compare Figs 3 and 4). Diurnal changes in activities were more pronounced in males (Fig. 3) than in females (Fig. 4). In the males they are clearly paralleled with the time spent for nectaring, while in females the times are similar but less clear. During a whole day, males fly twice as long as females (Fig. 5), although there has been an underestimation in the latter (compare 2.6.3). The number of flights per day however is greater in females (Tab. 5), resulting in a much lower duration per flight. Thus, within the habitat females mainly undertake very short flights (i.e. from one flower head or plant to the next in search for oviposition sites). In both sexes, some flights serve to reach nectar sources. Females also fly to reach egg laying sites. Potential nectar and egg laying plants can normally be reached in very short distances. Males repeatedly undertake longer flights searching for females. The more a male flies, the higher his probability of finding an unmated female. On each male there is selection to be more active in flying and thus more successful in finding unmated females than other competing males. Thus, we can expect a higher reproductive success in more actively flying males, which explains the observed differences in sexes in terms of flight.

In some butterfly species there are temperature-dependent differences in male searching behaviour for females, which might indirectly lead to a diurnal switch. In *Coenonympha pamphilus* (L.), for example, Wickman (1985) observed that males tend to perch within their territories at lower temperatures, while at higher temperatures they patrol. Also in *G. nausithous* males, the greatest flight activity is around noon, but temperature dependent change in behaviour (e.g. from patrolling to perching) was neither observed nor expected. As females copulate directly after eclosion and are not active flyers, it would represent a poor strategy for males to perch rather than patrol and actively seek newly eclosed females (see Rutowski, 1991, for a review on male mate-locating behaviour).

Because they patrol and mate with freshly emerged females, males have to stay within their habitat to reproduce successfully

rather than undertake long distance flights. The latter risk does not exist for females, which makes them more suitable agents for the (genetic) exchange between populations and the colonisation of new habitats (independent of the numbers of males which also leave the habitat). This fits to the observed higher flight distance of females and the observations that females have, perhaps temporarily, left the site more often than males.

Dispersal of males from one habitat to another, as observed by Binzenhöfer & Settele (2000) and Geißler-Strobel (2000) cannot be disregarded. Its relevance depends much on the distance between habitats or the degree of isolation of the original habitat. Nearby habitats might be reached so easily that individuals might be regarded as belonging to the same population (compare discussions of gradual changes from subpopulations to proper populations and finally metapopulations; e.g. Hanski 1999, Settele 1998). In such cases, male dispersal is expected.

4.5. **Movement and nectaring.** Nectaring is strongly associated with flight, especially in males (Fig. 3). Females of all age classes show more pronounced movement on flower heads than males (Figs 3, 4, 5), as females have to move for nectaring as well as between each egg laying event. In females, nectaring and egg laying may be combined as both activities often happen within a short time on the same flower head. Males and females both spend less time nectaring on the day of eclosion than when older (Fig. 5). The strong decline in nectaring of 3–10 days old males is probably due to the strong influence of the few but long lasting copulation events. Most probably in males and females, nectaring has the same duration, as e.g. also observed for *Anthocharis cardamines* (L.) by Wiklund & Åhrberg (1978).

As shown in Fig. 5, both sexes are active for the same period of time, although the type of activity is very different: males spend more time on long patrolling flights while females invest more time visiting flower heads and egg laying. It can be assumed that time of activity is temperature limited. However, the butterflies often rest around noon (Figs 3, 4), presumably to recover or to avoid overheating.

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Die geographische Variabilität von *Erebia flavofasciata*, nebst Beschreibung einer neuen Unterart (Nymphalidae: Satyrinae)

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Summary. According to the male wing-characters, the presently known populations of *Erebia flavofasciata* split up in three distinct morphological-geographical groups, the differentiation of which is a result of the isolation during the Würm glaciation: ssp. *flavofasciata* Heyne, [1895], inhabiting the Tessin mountains, ssp. *thiemei* Bartel, 1904, confined to the Bernina group, and ssp. *juliana* nov., which is found in the mountains north of the Inn valley and east of the Ticino valley, from the San Bernardino-pass in the west to the Samnaun-group in the east. Differentiation of ssp. *warreni* Verity, 1923 took place only in postglacial time.

Zusammenfassung. Die bisher bekannten Populationen von *Erebia flavofasciata* lassen sich auf Grund der Flügelmerkmale der ♂♂ in drei verschiedene geographisch-morphologische Gruppen gliedern, deren Differenzierung auf eine Würmglaziale Isolierung zurückzuführen ist: ssp *flavofasciata* Heyne, [1895] aus den Tessiner Alpen, ssp. *thiemei* Bartel, 1904 aus den Bernina-Alpen, und ssp. *juliana* nov., deren Areal sich östlich des Ticinotales und nördlich des Inntales vom San Bernardinopass bis in die Samnaun-Gruppe erstreckt. Die Differenzierung der ssp. *warreni* Verity, 1923 ist dagegen postglazialen Datums.

Résumé. D'après les caractères alaires des ♂♂, les populations connues d'*Erebia flavofasciata* se divisent en trois groupes morphologiquement et géographiquement distincts, dont la différenciation a été établie suite à l'isolement pendant la période glacière du Würm: la ssp. *flavofasciata* Heyne, [1895] des Alpes du Tessin, la ssp. *thiemei* Bartel, 1904 qui vit dans le groupe de la Bernina, et la ssp. *juliana* nov., qui se retrouve dans les montagnes à l'est de la vallée du Tessin et au nord de la vallée de l'Inn, du col San Bernardino à l'ouest, au groupe Samnaun à l'est. La différenciation de la ssp. *warreni* Verity, 1923 fut, au contraire, effectuée durant l'époque postglaciaire.

Riassunto. In base al disegno delle ali dei ♂♂, le popolazioni finora conosciute dell'*Erebia flavofasciata* si dividono in tre gruppi morfologici-geografici, la cui differenziatione fu effettuata durante l'isolamento nell'epoca glaciale del Würm: la ssp. *flavofasciata* Heyne, [1895], abitante delle Alpi Ticinesi, la ssp. *thiemei* Bartel, 1904, indigena del gruppo Bernina, e la ssp. *juliana* nov., che si ritrova diffusa nei monti a Nord della valle d'Inn ed ad Est della Val Leventina, tra il Passo di San Bernardino ed il Gruppo Samnaun. La differenziatione della ssp. *warreni* Verity, 1923 data solo dall'epoca postglaciale.

Key words: Nympahlidae, Satyrinae, *Erebia flavofasciata*, range, variation, new subspecies, Switzerland.

Einleitung

Erebia flavofasciata Heyne, [1895] hat ein stark zersplittertes Areal (Abb. 1). Die jetzt bekannten Flugplätze liegen in drei, von tiefen Tälern voneinander getrennten Gebirgsstöcken:

1. *Tessiner Alpen*. Hier kommt die Art im oberen Val Maggia zwischen Passo Campolungo und Passo Naret (Verity, 1953; Bischof, 1967), im oberen Val Formazza (Bischof, 1967), und am Alpe Veglia (Verity, 1953; Leigheb, 1976) vor. In den Tessiner Alpen fliegt die Nominatform.

2. *Bernina-Alpen*. Die Art fliegt hier lokal in den das Berninatal umschliessenden Bergketten (Bartel, 1904; Warren, 1923; Verity, 1923). Aus diesem Gebiet sind zwei Unterarten beschrieben worden: die ssp. *thiemei* Bartel, 1904, vom Schafberg oberhalb von Pontresina, und die ssp. *warreni* Verity, 1923[1], deren Typenlokalität sich auf der anderen Seite des Berninatales, im oberen Val Roseg befindet.

3. *Adula-Alpen*, *Albula-Alpen*, *Silvrettagruppe*, *Samnaungruppe*, die sich zu einer ununterbrochenen Gebirgskette nördlich des oberen Inntales und östlich des Ticinotales zusammenreihen. (Im Folgenden "Albulakette" genannt). Die bekannten Flugplätze liegen hier weit auseinander: San Bernardinopass und oberes Val Calanca (Vorbrodt, 1931), Julierpass (in der Literatur noch nicht belegt) und Fimbertal (Pfeiffer & Burmann, 1986). Es gibt in der Literatur keine Hinweise dafür, zu welcher Unterart die Populationen dieses Subareals gehören. Ziel dieser Arbeit ist es, die Angehörigkeit der Populationen der Albulakette zu bestimmen.

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[1] *thiemei* und *warreni* sind ursprünglich als Varietät beschrieben worden, sind jedoch gemäß Art. 45.6 der Code (ICZN) als Unterarten zu werten.

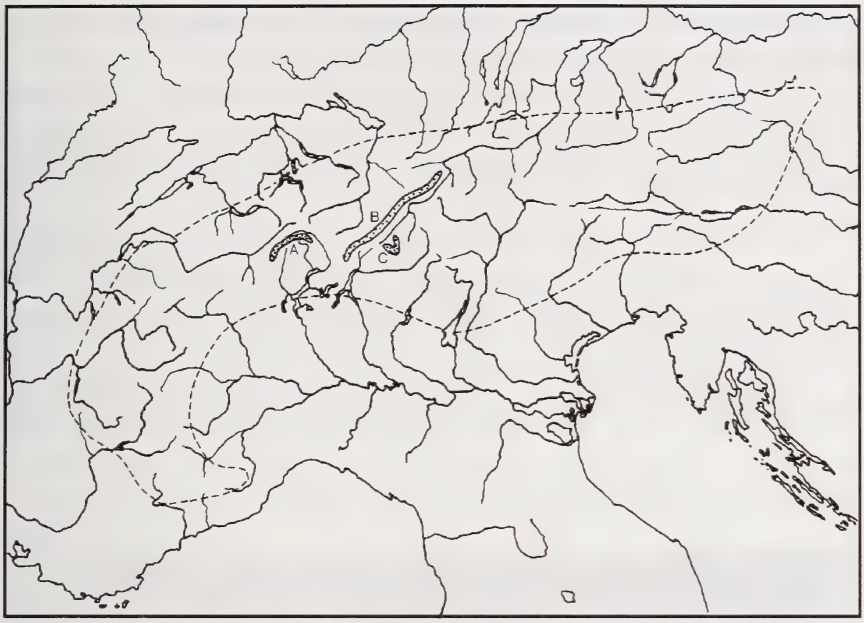

Abb. 1. Verbreitung von *Erebia flavofasciata*: A – Tessiner Alpen, B – Albulakette, C – Bernina-Alpen. Gestrichelte Linie: Grenze des Alpenraumes.

Material und Methoden

Herkunft des Materials. Damit die Variation zwischen den drei Gruppen mit der Variation innerhalb jeder Gruppe verglichen werden kann, wurden in jedem Teilareal Stichproben von mindestens zwei, möglichst weit voneinander entfernt vorkommenden Populationen gesammelt:

1. Alpe Veglia, oberhalb Varzo (Novara, Italien), 1850 m (westlichster Fundort der Art).
2. Alpe Pianascio, oberhalb Fusio (Tessin, Schweiz), 2000 m. Die Fundstelle ist in der Luftlinie ein Kilometer von der Typenlokalität von *E. flavofasciata* (Campolungopass) entfernt.
3. San Bernardinopass (Graubünden, Schweiz), 2200 m.
4. Julierpass (Graubünden, Schweiz), 2400–2500 m.
5. Fimbertal (Tirol, Österreich), 2500 m (östlichster Fundort der Art).

6. Schafberg, oberhalb Pontresina (Graubünden, Schweiz), 2400–2600 m, die Typenlokalität der ssp. *thiemei*.

7. Val Roseg, Tschierva Gletscher (Graubünden, Schweiz), 2200–2300 m, die Typenlokalität der ssp. *warreni*. (Die genaue Lage der Typenlokalität geht nicht aus Verity, 1923, sondern aus Warren, 1923 hervor).

Gemessene Merkmale. Die bisher beschriebenen Unterarten unterscheiden sich voneinander in der Ausdehnung der Bindenzeichnung auf der Flügeloberseite und -unterseite (Bartel, 1904; Verity, 1923).

Submarginalbinde der Hinterflügelunterseite. Als Maß der Ausdehnung der Binde wurde die Breite des gelben Flecks in Zelle

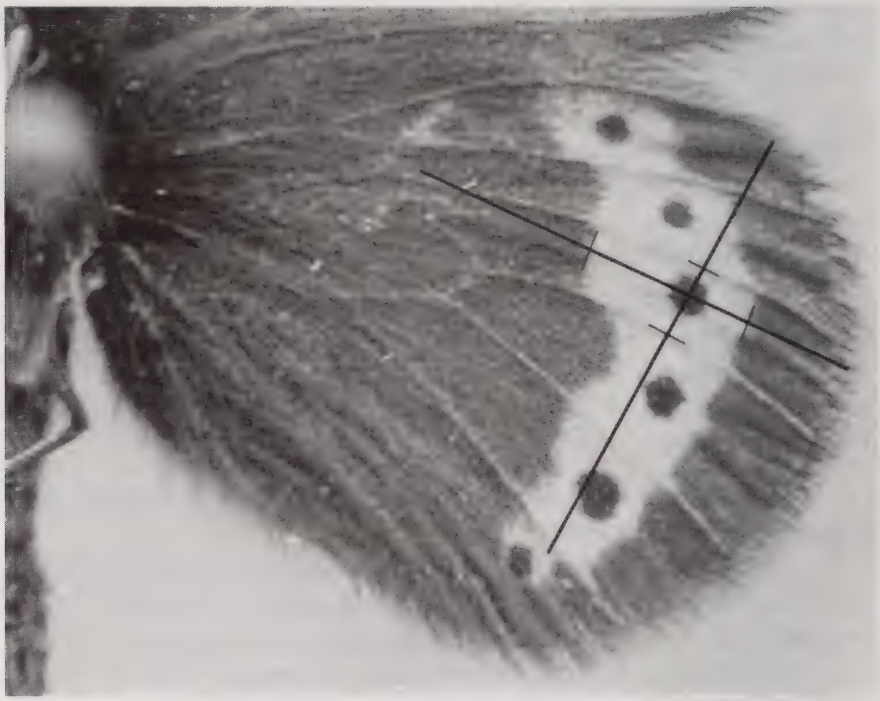

Abb. 2. Der Fleck in Zelle 4 der Hinterflügelunterseite. Breite und Höhe wurden entlang den eingetragenen Linien gemessen.

4 gemessen, und zwar genau durch die Mitte des schwarzen Zellpunkts (siehe Abb. 2). Es ist der breiteste Fleck der Binde, und deshalb am einfachsten zu messen, auch bei stark reduzierter Bindenzeichnung. Die Messung erfolgte mit einem Okularmikrometer bei einer Vergrößerung von ×20. Da die Falter geringe Größenunterschiede aufweisen, wurde zudem die Zellhöhe bestimmt, ebenfalls durch die Mitte des Zellpunkts. Daraus wurde das Verhältnis: Breite/Höhe berechnet.

Binde der Vorderflügeloberseite. Wegen der oft diffusen Begrenzung der Bindenflecke ist deren Breite nicht genau festzustellen. Deshalb wurde der Prozentsatz der Tiere, bei denen der Fleck in Zelle 3 völlig fehlt, bestimmt. Es ist dieser Fleck, der als erster dazu neigt, zu verschwinden.

Weil für eine statistische Bewertung zu wenig ♀♀ zur Verfügung standen bezieht sich diese Arbeit ausschließlich auf die Merkmale der ♂♂.

Ergebnisse

Hinterflügelunterseite. In Abb. 3 ist die Verteilung des Verhältnisses Breite/Höhe graphisch dargestellt. In Tabelle 1 sind die Populationsmittelwerte und die Standardabweichungen eingetragen. Die Unterschiede zwischen Populationen des gleichen Teilareals sind in allen Fällen weitaus geringer als die Standardabweichung. Beim Vergleich von Populationen aus verschiedenen Teilarealen sind die Unterschiede dagegen etwa zweimal so groß wie die Standardabweichung. Weil die Messwerte eine Normalverteilung aufweisen, lässt sich mit Students t-Test die Wahrscheinlichkeit, dass zwei Stichproben identischen Populationen entstammen, berechnen (siehe Tabelle 2). Der paarweise Vergleich von Populationen innerhalb eines Teilareals ergibt dabei p-Werte zwischen 0.02 und 0.97. Vergleicht man dagegen die Gesamtpopulationen der drei Teilareale miteinander, dann ergeben sich p-Werte von <0.0001. In Bezug auf die Bindenzeichnung der Hinterflügelunterseite lassen sich die studierten Populationen also in drei Gruppen gliedern. Diese entsprechen nicht den drei beschriebenen Unterarten (*flavofasciata*, *thiemei* und *warreni*), sondern den drei geographischen Teilarealen der Art (Tessiner Alpen, Albulakette und Bernina-Alpen).

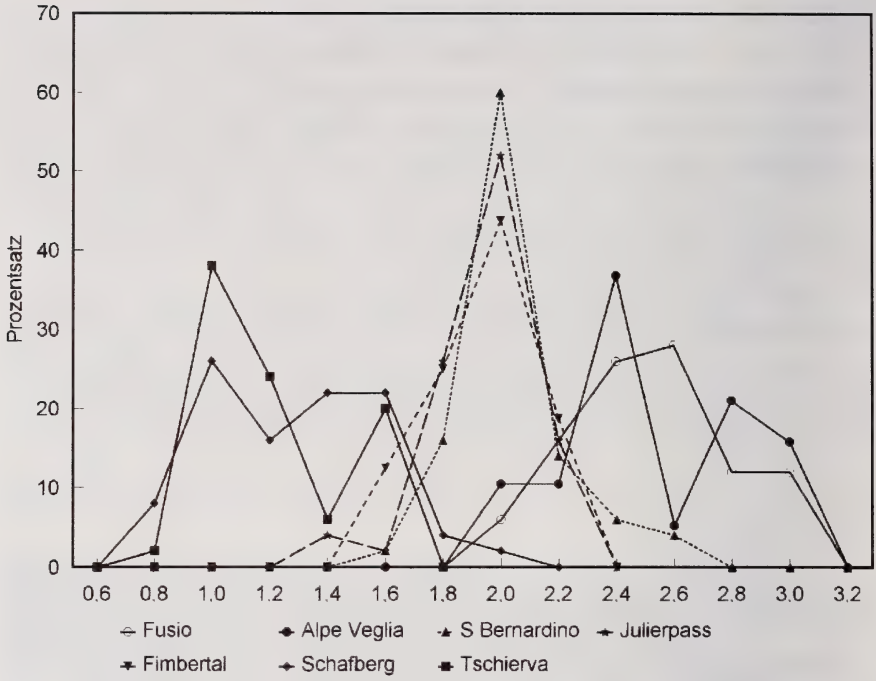

Abb. 3. Das Verhältnis: Breite/Höhe des Flecks in Zelle 4 der Hinterflügelunterseite der ♂♂.

Vorderflügeloberseite. In Tabelle 3 ist pro Population der Prozentsatz der Tiere ohne Fleck in Zelle 3 der Vorderflügeloberseite eingetragen. Hieraus ergibt sich die gleiche Dreiteilung der Populationen wie aus Tabelle 1. Der Prozentsatz der Tiere mit verloschenem Fleck ist in den Populationen der Albulakette um Faktor drei höher als in den Tessiner Alpen, und in den Bernina-Alpen wieder um Faktor drei höher als in der Albulakette. Mit dem χ^2-Test ist die Homogenität der Populationen der einzelnen Teilareale, sowie die von allen möglichen Kombinationen von Teilarealen berechnet (siehe Tabelle 4). Innerhalb der einzelnen Teilareale liegen die berechneten p-Werte zwischen 0.42 und 0.95; Kombinationen von Teilarealen ergeben p-Werte von 0.01 und niedriger.

Tabelle 1. Das Verhältnis: Breite/Höhe des Flecks in Zelle 4 der Hinterflügelunterseite der ♂♂.

	N	M	SD
Fusio	50	2.44	0.25
A. Veglia	19	2.44	0.27
S.Bernardino	50	1.96	0.20
Julier	50	1.86	0.20
Fimbertal	16	1.86	0.21
Schafberg	50	1.20	0.28
Tschierva	46	1.14	0.25

N – Zahl der untersuchten Falter; M – Populationsmittelwerte; SD – Standardabweichung.

Tabelle 2. Aus Students t-Test hervorgehende p-Werte beim paarweisen Vergleich des Verhältnisses: Breite/Höhe der untersuchten Populationen.

A. *Innerhalb eines Teilareals*	p-Wert
Fusio-A.Veglia	0.94
S.Bernardino-Julier	0.02
S.Bernardino-Fimbertal	0.10
Julier-Fimbertal	0.97
Schafberg-Tschierva	0.24
B. *Zwischen Teilareale*	
Tessin-Albula	<0.0001
Tessin-Bernina	<0.0001
Albula-Bernina	<0.0001

Tabelle 3. Zahl der ♂♂ mit (M) und ohne (O) Fleck in Zelle 3 der Vorderlügeloberseite. %O – Prozentsatz der Tiere ohne Fleck.

	M	O	%O
Fusio	80	2	2.4
A.Veglia	18	1	5.3
S.Bernardino	73	16	18.0
Julier	42	8	16.0
Fimbertal	13	3	18.8
Schafberg	13	35	72.9
Tschierva	16	30	65.2

Tabelle 4. Vorderflügeloberseite: Homogenität der einzelnen Teilareale und derer Kombinationen.

	p-Wert
Tessin	0.51
Albulakette	0.95
Bernina	0.42
Tessin+Albulakette	0.01
Tessin+Bernina	<0.0001
Albulakette+Bernina	<0.0001
Tessin+Albulakette+Bernina	<0.0001

Schlussfolgerungen.

In den beiden untersuchten Merkmalen liegt die gleiche morphologische Gliederung in drei Gruppen vor. Diese steht mit der geographischen Gliederung des Areals in Einklang. Dabei erweist sich die Form der Albulakette als morphologisch intermediär zwischen denen der Tessiner Alpen und der Bernina-Alpen. Aus Abb. 1 ergibt sich jedoch, dass es sich in der Albulakette nicht um Mischpopulationen handelt, sondern um ein selbständiges Taxon: die häufigsten Varianten der ssp. *flavofasciata* und von den ssp. *thiemei* und *warreni* sind in der Albulakette stark untervertreten, und umgekehrt.

Differenzierungsniveaus. Einer morphologischen Differenzierung liegt normalerweise eine langfristige Isolierung zugrunde. In diesem Fall, beim Entstehen der drei Gruppen von *E. flavofasciata*, geschah dies während der Würmeiszeit. Das lässt sich daraus schließen, dass man bei *E. flavofasciata*, wie bei fast allen Erebienarten, zwei Differenzierungsniveaus unterscheiden kann, die auf unterschiedliche Isolierungsphasen zurückgehen:

1. Auf dem niedrigeren Niveau gibt es die Unterschiede zwischen heute voneinander getrennten Populationen innerhalb des *gleichen* Teilareals (Unterschiede 1. Ordnung sensu Cupedo, 1997). Zum Beispiel die Unterschiede zwischen Alpe Veglia und Fusio; oder zwischen Schafberg und Val Roseg. Diese sind postglazialen Datums. Sie sind eine Folge der jetzt noch andauernden postglazialen Isolierung der einzelnen Populationen. Bei *E. flavofasciata* besteht wohl kaum Zweifel, dass der Genfluss zwischen den Populationen gegenwärtig völlig unterbrochen ist, und dass

diese Situation schon seit etwa zehn Jahrtausenden anhält. Die Abtrennung der ssp. *warreni* von der ssp. *thiemei* beruht also auf Unterschieden, die erst in postglazialer Zeit entstanden sind.

2. Auf dem höheren Niveau gibt es die Unterschiede zwischen den *Gesamtpopulationen* der drei Teilareale (Unterschiede 2. Ordnung). Diese müssen zustande gekommen sein in einer Periode, in der die (jetzt voneinander isolierten) Populationen jedes Teilareals noch eine einzige, zusammenhängende Population bildeten. Das war vor der Wiederbesiedlung der Alpen, in ihren Glazialrefugien irgendwo am Alpenrand, der Fall (für eine ausführlichere Auseinandersetzung siehe Cupedo, 1997). Das deutet darauf hin, dass sich *E. flavofasciata* während der Würm-Vereisung in drei verschiedene Refugien am Alpenrand zurückgezogen hat.

Taxonomie. *E. flavofasciata* lässt sich also in drei morphologisch erkennbare geographische Gruppen gliedern, deren Differenzierung durch langfristige (mehr als 100.000-jährige) Isolierung in voneinander getrennten Glazialrefugien zustande gekommen ist. Dies ist eine natürliche Gliederung der Spezies in Subspezies. Die ssp. *flavofasciata* bildet die erste Gruppe. Die zweite natürliche Einheit wird von den ssp. *thiemei* und *warreni* gebildet. Die noch nicht beschriebene Unterart der Albulakette nenne ich.

Erebia flavofasciata juliana ssp. nov.

Holotypus ♂, etikettiert: 'Julierpass (Graubünden, CH); 2400–2500 m.; 22.VII.[19]91; F.Cupedo leg.', in Coll. F. Cupedo. Paratypen: 39♂, 16♀ in Coll. F. Cupedo, 10♂ in Coll. Instituut voor Systematiek en Populatiebiologie (Zoölogisch Museum), Amsterdam. Alle mit gleichem Etikett.

Beschreibung. Die Submarginalbinde der Hfl.Us und Vfl.Os der ♂♂ sichtlich schmaler als bei der ssp. *flavofasciata*, jedoch nicht so reduziert wie bei der ssp. *thiemei* (Abb. 4 und 5).

Verbreitung. Adula-Alpen und Albula-Alpen, östlich bis in die Samnaungruppe.

Derivatio nominis. Der Name leitet sich vom Julierpass, der Typenlokalität der Unterart, her.

Weil der Unterschied zwischen den beiden Differenzierungsniveaus nomenklatorisch nicht zu erfassen ist, ist in Abb. 6 der

Abb. 4. *Erebia flavofasciata* ♂♂, Oberseiten: Links ssp. *flavofasciata*, Mitte ssp. *juliana* (zweite von oben: Holotypus), rechts ssp. *thiemei*.

Abb. 5. Wie Abb. 4, Unterseiten.

natürliche Zusammenhang der Unterarten von *E. flavofasciata* schematisch dargestellt.

Diskussion

E. flavofasciata ist ein Beispiel dafür, wie eine bestehende subspezifische Gliederung der Einsicht in die natürliche Gliederung einer Art im Wege stehen kann. Die Ursache davon ist, dass nicht alle beschriebenen Unterarten gleichwertig sind. Postglazial entstandene Unterarten sind mit Unterarten glazialen Alters nicht zu vergleichen. Postglaziale Differenzierung spielt sich bei den Erebien (und natürlich nicht nur bei diesen) auf Populationsniveau ab. Demzufolge beziehen sich Beschreibungen von postglazial differenzierten Unterarten prinzipiell nur auf eine einzige Population. Die Population vom San Bernardinopass könnte mit genau soviel Recht von der ssp. *juliana* abgetrennt werden, wie *warreni* von *thiemei*. Und im Grunde genommen trifft das für jede isolierte alpine Erebia-Population zu. Unterschiede 1. Ordnung sind daher für das Verständnis des natürlichen Zusammenhangs der Populationen (also für die Taxonomie) ohne Bedeutung. Beim Studium der Variabilität der einzelnen Arten ist dies zu berücksichtigen.

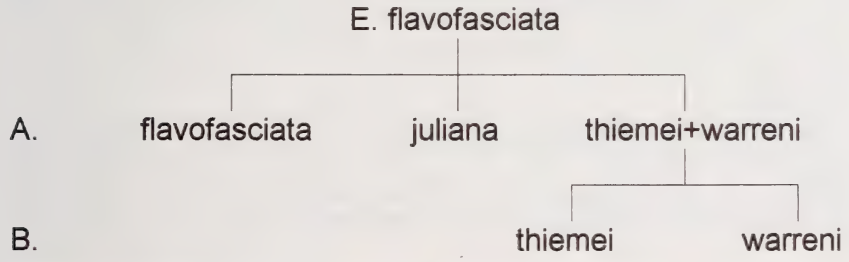

Abb. 6. Der natürliche Zusammenhang der Unterarten von *Erebia flavofasciata*:A – Gliederung infolge glazialer Isolierung, also auf Unterschiede 2. Ordnung gegründet; B – Gliederung infolge postglazialer Isolierung, also auf Unterschiede 1. Ordnung gegründet.

Dankwort

Die wertvollen Bemerkungen von zwei anonymen Referenten haben zu ansehnlichen Verbesserungen des Manuskripts geführt.

Besonderen Dank schuldige ich Herrn Manfred Pfeiffer (Ischgl, Österreich), dank dessen Bemühungen ich über eine Serie von *E. flavofasciata* aus der Samnaungruppe verfügen konnte, und Herrn Marcel Prick (Heerlen, Niederlande), der den deutschen Text korrigierte.

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Notes on some interesting Geometridae collected in Tuscany (Italy)

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Summary. Eleven species of Geometridae are listed. Among these, *Eupithecia orphnata* W. Petersen, 1909 is new for the Italian fauna and *Stegania cararia* (Hübner, 1790) is recorded for the first time from the Italian peninsula. Furthermore, six species are new for the fauna of Tuscany. For each species the presently known distribution in Italy is given.

Zusammenfassung. Elf Arten der Geometridae werden aufgelistet. Von diesen wird *Eupithecia orphnata* W. Petersen, 1909 erstmalig für die Fauna Italiens nachgewiesen, *Stegania cararia* (Hübner, 1790) erstmalig von der Apenninenhalbinsel. Weitere sechs Arten sind Neufunde für die Fauna der Toskana. Für jede Art wird die derzeit bekannte Verbreitung in Italien dargestellt.

Résumé. Onze espèces de Geometridae sont recensées. Parmi celles-ci, *Eupithecia orphnata* W. Petersen, 1909 est nouvelle pour la faune italienne et *Stegania cararia* (Hübner, 1790) est mentionnée pour la première fois de la péninsule italienne (déjà connue du Piémont). De plus, six espèces sont nouvelles pour la faune de Toscane. Pour chaque espèce, la répartition connue actuellement en Italie est présentée.

Key words: Lepidoptera, Geometridae, new records, Italy, Tuscany.

Tuscany is a region with a great diversity of environmental conditions and, consequently, a rich Lepidopteran fauna. Our present knowledge in this field is quite good, thanks to the efforts of many lepidopterists who carried out specific studies in this region during the last two centuries.

Nevertheless, the moth fauna in several areas of Tuscany still remains poorly known and, consequently, we have focused our attention on such areas.

The Apuan Alps is a mountainous chain that, despite its low elevation, has a cold alpine-like climate. This is evidenced by the presence of alpine species (e.g. *Erebia* spp.) that are absent in the Italian peninsula or limited to the higher altitudes in the central Apennines (Marche, Abruzzi, Lazio). The Farma Valley in the

"Colline Metallifere" (central Tuscany) is a well known refuge area. It is located in a warm Mediterranean region, but its peculiar geomorphology confers it meso-frigophilous characters. It is one of the two known localities of central Italy where *Archiearis notha* (Hübner, [1803]) is found (Fabiano & Zilli, 1998).

Our research in these areas, as well as in other interesting zones of Tuscany, led us to discover some rare or newly found Geometridae. This paper presents an annotated list of these species, among which *Eupithecia orphnata* W. Petersen, 1909 is also new for the Italian fauna.

Unless otherwise stated, the specimens have been collected by the authors and are being kept in their collection.

Chloroclysta miata (Linnaeus, 1758)

♂, Massa, Apuane Alps, Passo del Vestito, 1100 m, 9.X.1999.

Distribution in Italy: Trentino, Alto Adige, Veneto, Friuli (Wolfsberger, 1971), Emilia, Marche, Lazio, Abruzzi, Sardinia (Prola & Racheli, 1979; Raineri & Zangheri, 1995). — New for Tuscany.

Triphosia sabaudiata (Duponchel, 1830)

2♂, Lucca, Apuane Alps, Mount Matanna, 1050 m, 17.VII.1999.

Distribution in Italy: Piedmont, Lombardy, Trentino, Alto Adige, Veneto, Friuli, Emilia, Marche, Lazio, Abruzzi, Campania, Lucania (Parenzan, 1994). — Rare mountain species, occurring from 1000 to 2000 m and more. First record from Tuscany.

Solitanea mariae (Stauder, 1921)

2♂, Lucca, Apuane Alps, Fociomboli, 1230 m, 23.VII.1999; ♀, Siena, Farma Valley, Iesa, Carpineto, 200 m, 20.VIII.1999; ♂, ♀, Arezzo, Casentino, Moggiona, 700 m, 26.VI.1997, 4.VIII.1997; 2♂, Arezzo, Casentino, Camaldoli, 800–1000 m, 29.VII.1997, 23.IX.1997.

Distribution in Italy: Veneto, Liguria, Romagna, Tuscany, Umbria, Marche, Lazio, Campania, Lucania, Calabria (Parenzan, 1994). — Previous records of this species in Tuscany were scarce. It appears now to be well distributed in the region.

Eupithecia extraversaria Herrich-Schäffer, 1852

♂, Siena, Farma Valley, Iesa, Carpineto, 200 m, 13.VI.1997, F. Balderi leg. et coll.

Distribution in Italy: Trentino, Alto Adige, Veneto, Romagna, Marche, Lucania (Parenzan, 1994). — Scattered populations in the Alps. Extremely scarce in the Italian

peninsula where it appears to be confined to mountain areas between 1300 and 1400 m, except for a single female collected by P. Zangheri near Forlì (Fiumi & Camporesi, 1988). First record for Tuscany.

Eupithecia gueneata Mabille, 1862

♂, Lucca, Apuane Alps, Mount Matanna, 1050 m, 17.VII.1999.

Distribution in Italy: Lombardy, Trentino, Alto Adige, Veneto, Emilia, Lazio, Lucania, Calabria, Sicily (Parenzan, 1994). — New for Tuscany.

Eupithecia inturbata (Hübner, [1817])

♂, 3♀, Siena, Farma Valley, Iesa, Carpineto, 200 m, 8.IX.1999, 2.X.1999.

Distribution in Italy: Alto Adige (Dannehl, 1927), Emilia, Abruzzi (Flamigni, Bastia & Dapporto, *in prep.*). — The first record of this very rare species from Tuscany.

Eupithecia orphnata W. Petersen, 1909

2♀, Lucca, Apuane Alps, Mount Matanna, 1050 m, 21.VI.1999, 17.VII.1999.

Distribution in Europe: Sweden, Finland, Poland, Czech Republic, Slovakia, Germany, France, Spain, Switzerland, Austria, Hungary, Romania, Bulgaria, Albania (Karsholt & Razowski, 1996). — This species, typical of cold climates, is new for the Italian fauna. Its presence in the Apuane Alps is noteworthy, as it evidences the importance of this mountain chain as a refuge area for the northern species who colonised the Italian peninsula during the glacial periods. Many specimens of *Eupithecia subumbrata* ([Denis & Schiffermüller], 1775) have been collected in the same locality and at the same time. *E. orphnata* and *E. subumbrata* are difficult to tell apart by their wing pattern, although the first is usually darker. Correct identification depends on examination of the genitalia (Figs 1–2). *E. subumbrata* has been recorded for the first time in the northern Apennines to Poggio della Doganaccia (Pistoia) (Flamigni, Bastia & Dapporto, *in prep.*).

Stegania cararia (Hübner, 1790)

5♂, ♀, Siena, Farma Valley, Iesa, Carpineto, 200 m, 6.V.1999, 27.V.1999, 14.VII.1999, 13.VIII.1999; ♂, Siena, Farma Valley, Iesa, Carpineto, 200 m, 13.VI.1997, F. Balderi leg. et coll.

Distribution in Italy: Piedmont (Mariani, 1941), Brenta Mountains, and few other localities in the Alps (Hellmann, 1987). — This is the first record of the species for the Italian peninsula (Figs 3–5). The presence of this species in the Farma Valley is a further confirmation of the refugial character of the site. Besides the above mentioned *Archiearis notha*, *Eupithecia extraversaria* and *Eupithecia inturbata*, other species typical of colder climates like *Cleorodes lichenarius* (Hufnagel, 1767), *Gluphisia crenata* (Esper, 1785), *Lamprotes c-aureum* (Knoch, 1781), *Catocala fraxini* (Linnaeus, 1758) and *Hyphoraia testudinaria* (Geoffroy, 1785) are found here.

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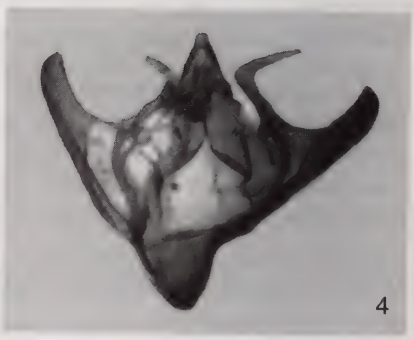
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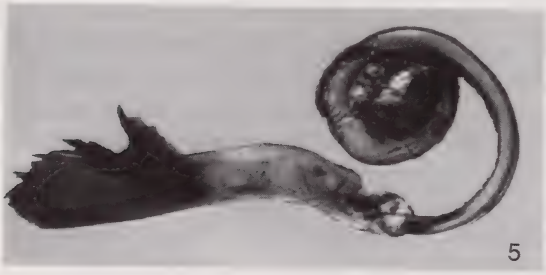
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Megalycinia serraria (A. Costa, 1881)

♀, Siena, Farma Valley, Bagni di Petriolo, 160 m, 20.IX.1998; 2♀, Arezzo, Casentino, Moggiona, 700 m, 18.IX.1995, 23.IX.1997.

Distribution in Italy: Emilia (Flamigni, 1990); Romagna, Tuscany, Marche, Umbria, Lazio, Abruzzi, Lucania, Calabria, Sicily (Parenzan, 1994). — This Italian endemic species has been recorded from about twenty localities of central and southern Italy. A single old record from Camaldoli (Arezzo) (Calberla, 1890) was known hitherto in Tuscany.

Cleorodes lichenarius (Hufnagel, 1767)

♂, Siena, Farma Valley, Bagni di Petriolo, 160 m, 20.IX.1998.

Distribution in Italy: Trentino, Piedmont, Lombardy, Romagna, Tuscany, Umbria, Lazio, Abruzzi, Apulia, Sicily, Sardinia (Parenzan, 1994), Friuli, Calabria (Parenzan *et al.*, 1998) Emilia (Flamigni, Bastia & Dapporto, *in prep.*). — This uncommon species is usually found in mountain habitats and is extremely rare at low altitudes. It had not been collected in Tuscany since the 19th century (Zeller, 1849; Calberla, 1890).

Yezognophos dilucidarius ([Denis & Schiffermüller], 1775)

2♂, Lucca, Apuane Alps, Campocatino, 10.VIII.1999.

Distribution in Italy: Trentino, Alto Adige, Veneto, Lombardy, Piedmont, Liguria (Wolfsberger, 1971). — An old record from Emilia appears to be doubtful and probably referable to *Yezognophos dognini* (Thierry-Mieg, 1910) (Flamigni, Bastia & Dapporto, *in prep.*). New for Tuscany.

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We are grateful to Mr Felice Balderi (Lucca), who kindly allowed us to examine his collection and to publish some of his data.

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←

Figs 1–5. 1. *Eupithecia orphnata*, female genitalia, Apuane Alps; 2. *Eupithecia subumbrata*, female genitalia, Apuane Alps; 3. *Stegania cararia*, Farma Valley; 4. *Stegania cararia*, male genitalia, Farma Valley; 5. *Stegania cararia*, aedeagus, Farma Valley.

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Material. Holotype @, Turkey, Hakkari, 8 km E. of Uludere, 1200 m, 10.VI.1984, H. van Oorschot leg. (ITZA). Paratypes: 7@, 3#, labelled as holotype; @, #, "Achalzich Chambobel 1910 Korb" (NHMW); 2@, #, Iraq, Kurdistan, Sersang, 1500 m, L. Higgins leg. (BMNH); @, Iraq, "Shaqlawa, 2500 ft, Kurdistan, 15/24 May 1957" L. G. Higgins leg. (BMNH).

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A catalogue of the type specimens of Palaearctic Riodinidae and Lycaenidae (Lepidoptera, Rhopalocera) deposited in the collection of the Museum für Naturkunde der Humboldt Universität zu Berlin

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Summary. A revision of the Lepidoptera collection of the Museum für Naturkunde der Humboldt Universität zu Berlin showed it to contain the type material of 3 nominal species-group taxa of Palaearctic Riodinidae and 273 of Lycaenidae; of these 42 label names were found to be unavailable as infrasubspecific (17), preoccupied (22; published replacement names are cited) and/or unpublished (3); the type material of 30 species-group taxa, thought to be deposited in the collection, was not found. Among others, the collection contains type material of Alphéraky, A. & O. Bang-Haas, Christoph, Grum-Grshimaïlo, Herrich-Schäffer, Klug, Kollar, Lederer, Püngeler, Rebel, Staudinger and others.

Zusammenfassung. Eine Revision in der Schmetterlingssammlung des Museums für Naturkunde der Humboldt Universität zu Berlin zeigte, daß das Typenmaterial nomineller Taxa der Artengruppe von 3 paläarktischen Riodinidae sowie 273 Lycaenidae vorhanden ist; von diesen sind 42 Namen nicht verfügbar als infrasubspezifisch (17), präokkupiert (22, veröffentlichte Ersatznamen werden zitiert) und/oder unveröffentlicht (3); das Typenmaterial von 30 Taxa der Artengruppe, welches in der Sammlung vermutet wurde, konnte nicht gefunden werden. Die Sammlung enthält unter anderem Typenmaterial von Alphéraky, A. & O. Bang-Haas, Christoph, Grum-Grshimaïlo, Herrich-Schäffer, Klug, Kollar, Lederer, Püngeler, Rebel, Staudinger u. a.

Résumé. Une révision de la collection de lépidoptères du Museum für Naturkunde der Humboldt Universität zu Berlin a démontré que celle-ci contient le matériel type de 3 taxons nominaux du niveau espèce de Riodinidae et 273 de Lycaenidae; parmi ceux-ci, 42 noms se sont révélés non disponibles, étant infrasubspécifiques (17), préoccupés (22; les noms de remplacement publiés sont cités) et/ou non publiés (3); le matériel type de 30 taxons du niveau espèce, supposé être déposé dans la collection, n'a pas été retrouvé. La collection comprend, entre autres, du matériel type d'Alphéraky, A. & O. Bang-Haas, Christoph, Grum-Grshimaïlo, Herrich-Schäffer, Klug, Kollar, Lederer, Püngeler, Rebel, Staudinger et autres.

Key words: Lepidoptera, Rhopalocera, Riodinidae, Lycaenidae, Museum für Naturkunde der Humboldt Universität zu Berlin, collections, type specimens, nomenclature.

...et non est creatura invisibilis in conspectu eius, omnia autem nuda et aperta sunt oculis eius, ad quem nobis sermo.
Ad Hebraeos 4, 13

The Museum für Naturkunde der Humboldt Universität zu Berlin is a depository of the largest and most important reference collection of the Lepidoptera in Europe. It contains the type series of the species-group nominal taxa established during the 19th and 20th centuries by the founders of modern lepidopterology Gottlieb August Wilhelm Herrich-Schäffer, Julius Lederer, Otto Staudinger and their successors Andreas and Otto Bang-Haas and many of their contemporaries, giving the Museum an importance of the Promised Land for anyone involved with systematics, taxonomy, nomenclature, faunistics and zoogeography of Palaearctic and extra-Palaearctic Lepidoptera.

This publication is one of the results of my research visit to the Humboldt University Natural History Museum during October–December 1998, sponsored by the Deutscher Akademischer Austauschdienst (DAAD). At the outset of this project, the Palaearctic Riodinidae/Lycaenidae collection was rearranged to assemble chaotically diffused material into an integrated body convenient for practical use.

A first examination of the Lepidoptera collection as a whole brought to light that Palaearctic Riodinidae/Lycaenidae material was scattered among 5 main more or less compact collection bodies left almost intact since their arrival to Berlin:

(1) Primary collection arranged by Klug or under Klug's supervision (early 1820's).

The Berlin Lepidoptera collection became renowned after 1818, when Johann Christoph Friedrich Klug took up the post of the second director (after Illiger) of the Zoological Collection. From this time on (tentatively from between the 1820's and 1830's) a documentary history of the collection begins in form of a hand-written inventory book entitled *Catalogus Generalis Musei Zoologici Berolinensis*. The Lepidoptera section of this document is bound in several volumes (Vol. 1: Nos 1–3753; Vol. 2: Nos 3754–10098 enumerated in chronological order but not dated — see Appendix) and is deposited in the Museum's Lepidoptera Section library. It reflects the collection inventory connected with the collection itself through the specimens' inventory numbers

(first column of each *Catalogus* entry/row). In its original arrangement, the specimens were placed in conventional insect drawers, each series or single specimen under a drawer label with species-group name and author, reference to original and subsequent descriptions and illustrations, locality and collector (provider); the first specimen below the drawer label was labelled with a printed inventory number referring to a *Catalogus Generalis* row of the following columns: inventory (label) number | binominal or trinominal name | number of specimens | locality | collector/provider. All these data, along with those contained in the original description, may provide some evidence for the origin and thus for the nomenclatural status of the specimen(s). All *Catalogus Generalis* entries for type specimens are quoted in the Appendix below.

(2) Staudinger collection (including Lederer and partly Herrich-Schäffer collections as an integral part; received 1948 — see Horn *et al.*, 1990: 168, 229, 377).

The Staudinger collection, in its primary state, has been placed in so-called "glass cases": wooden drawers with a glass lid and a glass bottom supplied with transverse grooved wooden bars parallel to smaller side. The groove of each bar is filled with a cork- or peat-like material in which pinned specimens could be set in one line columns far enough from one another to accommodate specimen wingspan. To save space, the specimens in a column were originally pinned tilewise overlapping (Fig. 1, bottom left), causing a tangible inconvenience in manipulations that often resulted in damage from clumsy handling. Each species-group taxon was set under a drawer name label, with each series beginning with a specimen having a handwritten coloured locality label; the rest of the specimens from the same locality are usually labelled with circles punched from the same label paper as the locality label. In addition to locality labels, most of the type specimens also have a characteristic printed label "Origin.[al]" (on pink paper), with the first specimen in the type series being supplied with a handwritten (by Staudinger) identification label. The specimens from the Lederer collection were signed by Staudinger with printed labels "Coll. | Led." (on white paper). In case of non-designated types, when their type status (as syntype or holotype by monotypy) was traced and determined now by external unambiguous proof, they were provided with new designation labels.

(3) Bang-Haas (A. & O.) collection (received 1948 — see Horn *et al.*, 1990: 27, 377).

(4) Püngeler collection (acquired 1928 — Horn *et al.*, 1990: 314).

(5) New contributions from different donors (mostly after World War II) irregularly placed into free space in any cabinets and drawers.

When I reorganised the collections, the specimens were removed from the primary collections, pinned into plastic unit trays in their original order (each taxon separately) and assembled in conventional collection drawers to be housed in special new cabinets (Fig. 1, top left and right). Each specimen was supplied with a printed label to indicate the collection of origin: "ex coll. | STAUDINGER", "ex coll. | [A. and/or O.] BANG-HAAS", "ex coll | PÜNGELER" and "Zool. Mus. | Berlin" (for specimens of the primary collection and new contributions as specified respectively under (1) and (5) above). The specimens of the type series were

marked with the same labels numbered with fraction numbers to show the number of specimens in a series and a serial number of a specimen in its original position (for instance, 2/8 means second specimen in a series of eight). The type material has been placed in separate unit trays clearly designated with recognisable drawer labels.

All of Klug's extant Rhopalocera type material is now merged in two clearly marked drawers and is easily accessible (for a complete review see Olivier & Nekrutenko, 2000).

In the present publication, the extant type specimens (syntypes, holotypes by monotypy and, when validly fixed, lectotypes, paralectotypes, neotypes with reference to primary sources) of the riodinid and lycaenid butterfly nominal species-group taxa deposited in the Lepidoptera collections of the Museum für Naturkunde der Humboldt Universität zu Berlin are listed and commented. The species-group taxa names are arranged in alphabetical order, separately for Riodinidae and Lycaenidae.

Each entry opens with the species-group name originally applied to the specimens, with its author and date (as a heading line); available names are given in **boldface**, unavailable ones (infrasubspecific, junior homonyms, unpublished, nomina nuda) in lightface (as here) characters; with homonyms and unpublished names not italicized). The heading line is followed by a paragraph containing original combination quoted from the primary source with full reference; a section *Type locality* containing a quotation from the original description along with data on the type material when stated; then, after an em-dash (—), a synonymy, homonymy (and a replacement name when available) are given with reference to the appropriate literary sources.

For each specimen the label text is quoted in single quotation marks in following order: identification and locality label; accessory label(s) (origin, depository, inventory (catalogue) nos. etc.); designation label(s). In cases when a specimen is considered to belong to the type series only doubtfully, it is indicated in the list with a question mark (?-♂ or ?-♀).

In the section *Types* (entitled, dependent on status, as *Syntype(s)*, *Holotype*, *Paratype(s)*, *Allotype*, *Lectotype*, *Paralectotype(s)*, *Neotype*), to assist better recognition of the specimen, the quotation of each label is provided with the characteristics of the paper on which it is written. In run-in quotations, each line of the label text is separated by a vertical line (|). All extensions of abbreviations used in the label text are enclosed in square brackets ([ ]); necessary comments or remarks inserted in the label text are given in angle brackets (< >). The square brackets are still used here to include the year of publication established after external sources, although this is no longer recommended in the current edition of the Code. In quotations of combined labels (handwritten on printed forms), the handwritten text is reproduced *in italics*; completely handwritten and completely printed labels are quoted in a standard character face (as here); the printed labels are quoted with their original text layout. When important and known, for handwritten text the writer's name is given in parentheses.

This Catalogue reflects the state of the collection on 31 December 1998. Subsequent taxonomic treatments (lectotype designations etc.) will, however, briefly be referred to, with reference to the publication.

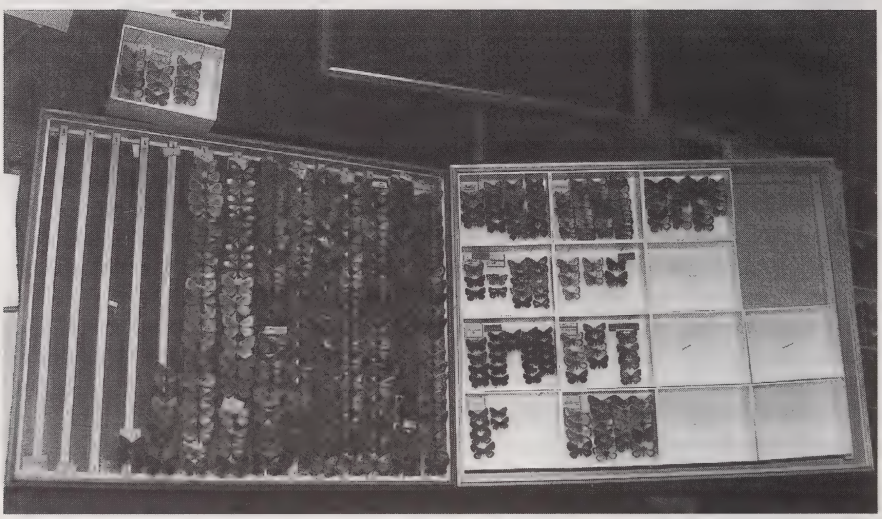

Fig. 1. — Lycaenidae in the collection of the Museum für Naturkunde der Humboldt Universität zu Berlin, before (bottom left) and after (top left, right) rearrangement for the purpose of the present Catalogue.

RIODINIDAE

lua Grum-Grshimaïlo, [1891]

'*Polycaena Lua*' Grum-Grshimaïlo, [1891]: 454. Type locality: 'In montibus Sinin-Schan detecta'.

Syntypes 2♂, ♀:

- ♂ with handwritten labels: 'Thibet | Sinin Alp.[es] | [18]90 [legit] Gr. Gr.' (on brown paper), small date label '27.VI.[18]90' (on faded white paper, Grum-Grshimailo), 'Polycaena | Lua | Sinin Schan' (on white faded paper, A. Bang-Haas);
- ♂, ♀ with circles of brown locality label paper.

The syntypes, received by Staudinger from Grum-Grshimaïlo, are provided now with a printed label '*lua* | Grum-Grshimailo [1891] | SYNTYPUS | Y. Nekrutenko det. 26.11.1998' (on yellow paper).

tamerlana Staudinger, 1886

'*Polycaena* (nov. genus) *Tamerlana* Stgr.' Staudinger, 1886: 227. Type locality: '...wurde 1882 von Haberhauer jun. bei Osch entdeckt... Später erhielt ich auch Stücke vom Alai und Namangan...'

Syntypes 9♂, 4♀:

- ♂ with labels: handwritten (Staudinger) 'Polycaena Stgr. | Tamerlana Stgr.' (on white paper), handwritten 'Margelan | Maur.[er] [18]84' (on brown paper), printed 'Origin.' (on pink paper) and a cut [from envelope or wrapper?] 'von 17/6 bis 29/6 <year?>' (on white faded paper);
- ♂ with labels: handwritten 'Osch | Hbh. [Haberhauer]' (on brown paper), handwritten date label '19/7 [1882]' (on white paper) and printed 'Origin.' (on pink paper);
- 5♂, 3♀ with circles of brown locality label paper and printed 'Origin.' (on pink paper), one ♂ also with handwritten (Staudinger) label 'Tamerlana | Stgr.' (on white paper);

- ♂ with labels: handwritten 'Namangan | Hbh. [Haberhauer] [18]84' (on brown paper) and printed 'Origin.' (on pink paper);
- ♂, ♀ with circles of brown locality label paper and printed 'Origin.' (on pink paper).

timur Staudinger, 1886

'*Polyc.*[*aena*] *Tamerlana* var *Timur* Stgr.' Staudinger, 1886: 230. Type locality: 'Herr Tancré sandte mir von seinem Sammler Rückbeil im Kuldja-District gefundene Polycaena...'

Syntypes 6♂, 3♀:

- ♂ with labels: handwritten (Staudinger) 'v. Timur | Stgr.' (on white paper), handwritten 'Kuldja | Rkbl. [Rückbeil] [18]84' (on brown paper), printed 'Origin.' (on pink paper);
- 5♂, 3♀ with circles of brown locality label paper and printed 'Origin.' (on pink paper), one male specimen also has a handwritten (Staudinger) label 'v. Timur | Stgr.' (on white paper).

LYCAENIDAE

acamas Klug, 1834

'*Lycaena Acamas*' Klug, 1834: Decas Quarta: Signature *k*(iv), Tab. 40, Figs 7–9. Type locality: 'Habitat in Syria et Arabia felici'.

Types: not found (*Catalogus Generalis*: 4105, 4106 — see Appendix); probably in The Natural History Museum in London (a passage 'The only specimens I have seen are 1 ♂ from Klug's type material, Butler's type ♀ of *bellatrix* from Suakin in the British Museum, and a cotype of the latter in Mr. Joicey's collection' (Riley, 1925: 88) suggests at least one of Klug's types to be deposited in (or received on loan by) the British Museum).

Lectotype ♀: '...females in figs 8 and 9 [of the *Symbolae Physicae*] are of "Syrian" origin. In order to avoid upsetting established usage it seems best to restrict ssp. *acamas* to Syrian populations by designating the female upperside illustrated as the actual type specimen' (Larsen, 1983: 377; ICZN Art. 74.4).

acaudata Staudinger, 1901

'*Thecla Lunulata* Ersch. v. *Acaudata* Stgr.' Staudinger, 1901: 70. Type locality: 'Ferg.[ana]'.

Syntypes 6♂, 5♀:

- ♂ with labels: handwritten (Staudinger) 'Lunulata var. | Acaudata Stgr.' (on white paper) and handwritten 'Margelan | Hbhr. [Haberhauer]' (on brown-pink paper);
- 3♂, ♀ with circles of brown-pink locality label paper, ♀ has also handwritten date label '30/5 [18]80' (on white paper);
- ♂ with handwritten label 'Taschkend | [18]91 Schott' (on brown paper);
- ?-♂ with handwritten label 'Alex.[ander] Geb.[irge] | [18]86 Hbhr. [Haberhauer]' (on brown paper);
- ♀ with labels: handwritten 'Osch | Hbhr. [Haberhauer] [18]82' (on brown paper) and date label '26/6' (on white paper);
- ♀ with circle of brown locality label paper and handwritten date label '18/6' (on white paper);
- ♂ with labels: handwritten 'Namangan | Hbh. [Haberhauer] [18]84' (on brown paper) and date label '6/6' (on white paper);
- ♀ with a circle of brown locality label paper.

Likewise most of the Staudinger species-group taxa becoming available after his death in 1900 (i. e. in Staudinger, 1901), the type specimens were not designated with characteristic 'Origin.' labels.

The specimens are provided now with a printed label '*acaudata* Staudinger, 1901 | SYNTYPUS | Y. Nekrutenko det. 3.11.1998' (on yellow paper).

actinides Staudinger, 1886

'*Lyc.*[*aena*] *Actis* var. *Actinides* Stgr.' Staudinger, 1886: 214. Type locality: 'Diese ist bei dem vorliegenden ganz frischen ♂ aus dem südlichen Alai…'

Holotype ♂ (by monotypy):

- ♂ with labels: handwritten (Staudinger) 'Actinides | Stgr.' (on white paper), and 'Alai | [18]85 Hb. [Haberhauer]' (on brown

paper), small new label '68' (on white paper), printed 'Origin.' (on pink paper) — cf. Häuser & Eckweiler (1997: 59); Eckweiler & Häuser (1997: Pl. 10).

The specimen is provided with a printed label '*actinides* Staudinger, 1886 | HOLOTYPUS (par monotypiam) | Y. Nekrutenko det. 4.11.1998 | cf. Häuser & Eckweiler, Nachr.ent.Ver.Apollo Suppl. 16: 59 (1997)' (on red paper).

actis Herrich-Schäffer, [1851]

'[*Lycaena*] *Actis*' Herrich-Schäffer, [1851] **1**(49): Tab. 104, Figs 496–499; [1851] **6**(55): 24. Type locality: 'Aus Kleinasien'.

Syntypes ♂, ♀:

- ♂ with labels: handwritten 'Actis | HSch. f. 496-97| Atys Kind.[ermann] ms. Gerh.[ard] | t. 19. f. 3. | Amasia Kind[ermann]' (recto yellow, in printed box, verso white), printed '4723' (on white paper);
- ♀ without any label.

Catalogus Generalis: 4723 — see Appendix; cf. Häuser & Eckweiler (1997: 59).

The specimens are provided now with a printed label '*actis* Herrich-Schäffer, [1851] | SYNTYPUS | Y. Nekrutenko det. 30.11.1998' (on yellow paper). Subsequently, Olivier (2000a: 105–106) has designated the ♂ specimen as lectotype and the ♀ specimen as paralectotype, further restricting the type locality as 'Turkey, Tokat province, env. Tokat'.

aedon Christoph, 1877

'*Lycaena Aedon* Chr.' Christoph, 1877: 236, Tab. 5, Fig. 8. Type locality: 'Ich fing überhaupt nur 3 ♂♂ davon bei Schahkuh im Juli'.

Syntype ♂:

- ♂ with labels: handwritten 'Schahkuh | Chr.[istoph]' (on yellow paper) and printed 'Origin.' (on pink paper).

aegagrus Christoph, 1873

'*Lycaena Aegagrus* Chr.' Christoph, 1873: 24, Tab. 1, Figs 3, 4. Type locality: 'Ich fand der Schmetterling nur auf einer etwa 10–11,000' hoch gelegenen... muldenartigen Einsenkung am Schahkuh'.

?-Syntypes ♂, ♀:

- ♂, ♀ with labels: handwritten (Püngeler) 'Hyrcania' (on white paper, in printed box) and handwritten (Püngeler) on printed form 'Cotype <underlined> | *v. aegagrus Chr.* ♂ (♀) | *von Stgr.* | *Püngeler*' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Pyrenaica B. | v. Aegagrus Chr.' (on white paper, in printed box).

aereus Eckweiler, 1998

'*Polyommatus* (*Agrodiaetus*) *antidolus* subsp. *aereus* ssp. nov.' Eckweiler, 1998: 220, Farbtafel 1. Type locality: 'Iran, Azarbayjan-e-Gharbi, Takab, 10 km E Takht-e-Soleyman, 2300 m (Iran, Zagros mts.)'.

Paratype ♂:

- ♂ with printed labels: 'Iran, Azarbayjan-e-Gharbi | 10 km E Takht-e-Soleyman | 2300 m, 24.-25.VII.1998 | leg. Eckweiler 548' (on white paper, in box) and '**Paratypus** | *Polyommatus (Agrodiaetus)* | *antidolus* ***aereus*** subsp. nov. | ECKWEILER 1998' (on bluish paper, in box).

aeruginosa Staudinger, 1881

'*Lycaena Cyllarus* Rott. var. *aeruginosa*' Staudinger, 1881: 285. Type locality: 'Ala Tau'.— Junior subjective synonym of *Papilio alexis alexis* Poda, 1781.

Syntypes 2♂, ♀:

- ♂ with labels: handwritten 'Saisan | Hbhr. [Haberhauer]' (on brown paper) and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Lepsa | Hbhr. [Haberhauer]' (on brown paper) and printed 'Origin.' (on pink paper);
- ♀ with circle of brown locality label paper and printed 'Origin.' (on pink paper).

The specimens are placed under a handwritten drawer label 'Aëruginosa | Stgr.' (on white paper, in box).

aestiva Staudinger, 1871

'*Lycaena Astrarche* Bgstr. v. gen. II (m.) *Aestiva*' Staudinger, 1871a: 11. Type locality: not stated. — Junior subjective synonym of *Lycaena calida* Bellier, 1862. — Infrasubspecific.

Syntypes 8♂, ♀:

- ♂ with labels: handwritten (Staudinger) 'Sn Ildefonso | m.[ihi]' (on blue-green paper), printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten (Staudinger) 'Sier. d. Alfcr. | m.[ihi]' (on blue-green paper), small date label '29/6', printed 'Origin.' (on pink paper);
- ♂ with circle of blue-green locality label paper and printed label 'Origin.' (on pink paper);
- ♂ with labels: handwritten (Staudinger) 'Granada | m.[ihi]' (on blue-green paper), small date label '6/8', printed 'Origin.' (on pink paper);
- ♀ with labels: handwritten (Staudinger) 'Sier. Nev. | m.[ihi]' (on blue-green paper), printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Sardinia m.[ihi]' (on pale pink paper), printed 'Origin.' (on pink paper);
- ♂ with circle of pale pink locality label paper and printed label 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Graecia | Kr.[ueper]' (on yellow paper), small square piece of green paper, printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Parnass | 24/6 [18]65' (on white paper), circle of yellow locality label paper above and printed 'Origin.' (on pink paper).

affinis Staudinger, 1892

'*Thecla Affinis* Stgr. n. sp.' Staudinger, 1892b: 148. Type locality: 'brachte Dörries 3 gute (franzenreine) anscheinend gefangene ♀♀ aus dem Sutschan-Gebiet mit...' — Junior subjective synonym of *Thecla eximia* Fixsen, 1887 (Staudinger, 1901: 69).

Syntypes 3♀:

- ♀ with labels: handwritten 'Sutschan | [18]90 Dörr.[ies]' (on blue-violet paper) and printed 'Origin.' (on pink paper);
- 2♀ with circles of blue-violet locality label paper, one with printed 'Origin.' (on pink paper).

agnata Staudinger, 1889

'*Lycaena Agnata* Stgr (*Christophi* var.?)' Staudinger, 1889: 19. Type locality: '...sandte mir Herr Tancré 5 ♂ und 2 ♀ ein, die Rückbeil in den Gebirgen südlich vom Issyk-Kul fing....'

Syntypes 3♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'v. Agnata Stgr. | Rogneda Gr. Gr.' (on white paper), handwritten 'Issyk-Kul | mer.[idionalis] occ.[identalis] | 18[88] Rckbl. [Rückbeil]' (on brown paper), printed 'Origin.' (on pink paper);
- 2♂, 2♀ with circles of brown locality label paper and printed 'Origin.' (on pink paper).

alaica Staudinger, 1886

'*Lyc.*[*aena*] ... *Cytis* var. *Alaica* Stgr.' Staudinger, 1886: 206, 207. Type locality: '...auf dem Alai (bei Margelan)...' — Junior subjective synonym of *Lycaena cytis panaegides* Staudinger, 1886 (Staudinger, 1901: 80).

Syntypes 5♂, 4♀:

- ♂ with labels: handwritten (Staudinger) 'var. Alaica | Stgr.' (on white paper), 'Alai | 85 Hbh. [Haberhauer]' (on brown paper), printed 'Origin.' (on pink paper);
- 4♂, 4♀ with circles of brown locality label paper and printed 'Origin.' (on pink paper) (figured in Tshikolovets, 1997a: 133, 238, pl. 40, figs 9(11); one male specimen has also labels: handwritten (Staudinger) 'Cytis var. Alaica | Stgr.' with insertion in pencil 'Alai' (on white paper), large handwritten 'v. Panaegides | Stg.| = v. Alaica | Stg.' (in pencil, on white paper).

alaina Staudinger, 1887

'*Lycaena Alaina* Stgr.' Staudinger, 1887a: 50. Type locality: '...sandte mir Maurer 10 Stücke aus dem südlichen Alai (Transalai) ein, unter denen nur ein ♀ ist.'

Syntypes 4♂, ♀:

- ♂ with labels: handwritten (Staudinger) 'Alaina | Stgr.' (on white paper), handwritten 'Transalai | [18]86 Maur.[er]' (on brown paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), printed 'Origin.' (on pink paper), handwritten 'Gen. Prep. | N 3096 ♂';
- 3♂, ♀ with circles of brown locality label paper and printed 'Origin.' (on pink paper) — figured in Tshikolovets (1997b: 40, figs 12–15);
- ♂ with labels: printed 'Tura' (on white paper faded yellowish, in box), 'Staudinger' (on white paper faded yellowish, in box), handwritten (Püngeler) 'alaina ♂, | Cotypus <underlined> | 11/09 ex coll. | Dieckmann' (on white paper) and handwritten (Püngeler) on printed form 'Cotype <underlined> | *alaina Stgr.* ♂ | *Püngeler*' (on pink paper).

The specimens are placed under handwritten (Püngeler) drawer label 'Alaina Stgr.' (on white paper, in box).

albicans Gerhard, [1851]

'*Lycaena Corydon Hbr.*[Hübner] *Var. Albicans Hbr.*' Gerhard, [1851] (8): 17, Pl. 31, Fig. 3 a–d. Type locality: 'Spanien' ... 'Auch diese Var. stammt aus Spanien... Den Mann besitze ich, das Weibchen erhielt ich durch Herrn Lederer.' — Junior primary homonym of *Lycaena dorylas albicans* Gerhard, [1851].

Neotype ♂:

- ♂ with labels: handwritten 'Granada | m.[ihi] [18]80' (on pale greenish paper), 'albicans' (on white paper, in ball pencil), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Schurian) on printed lined form '*Polyommatus* | *(Lysandra)* | *albicans* | *GERHARD 1851* | *det. Schurian* 1988' (on white paper), handwritten (Schurian) on printed form 'Gen. Präparat | Nr. *208*/1984 | *Schurian*', handwritten (Schurian) on printed form 'Neotypus ♂ | *Lysandra albicans* | *H.-S. (1852)* | *teste*

SCHURIAN 1984' (on red paper), and '*Neotypus* ♂ <written over printed 'Paratypus'> | *Lycaena* | *corydon albicans* | *GERHARD 1851* | det. Schurian, 1988' (on red paper, in box) — Schurian (1988: 134, Taf. 1, 2, Fig. 3).

albicans Herrich-Schäffer, [1851]

'[*Lycaena*] *Corydon var. albicans*' Herrich-Schäffer, [1851] **1**(47): Tab. 103, Figs 494, 495; [*Lycaena*] *Corydon* Zell. [Lokalvarietät] *Albicans* [1852] **6**(55): 27. Type locality: 'Aus Spanien.'— Junior primary homonym and junior subjective synonym of *Lycaena corydon albicans* Gerhard, [1851]. The priority of Gerhard's name over that of Herrich-Schäffer's [1851] is established here after Koçak, 1980c: 17 (cf. ICZN Art. 21.3.1, 21.3.2).

Types: not found.

alexandra Püngeler, 1901

'*Chrysophanus athamantis* Ev. var. nov. *alexandra*' Püngeler, 1901: 179, Taf. 2, Fig. 6, 6a, 6b. Type locality: '...in Anzahl aus dem Alexandergebirge'.

Lectotype ♂:

- ♂ (the end of abdomen removed, genitalia in a plastic tube) with labels: printed, with handwritten (Püngeler) insertion 'Asia centr.[alis) | *Alexandergebirge* | *Rückbeil 1899* (recto, in box) | *athamantis var.* | *alexandra Püng.* ♂ | *Original* <double underlined> *Oberseite* | *abgebildet Iris 1901* | *(v. R. Tancré 1.01)* (verso)' (in white paper), printed 'Type' <double underlined> | with handwritten (Püngeler) insertion 'v. alexandra Püng. ♂ | Püngeler' (on pink paper), printed 'Zool. Mus. Berlin' (on pale yellow paper), handwritten (Nekrutenko on printed form 'Figurat | par Y. Nekrutenko in: | *Vestn. zool., 1984, 6:* | *tab. ex adv. p. 48*' (in white paper, in box), handwritten (Nekrutenko) 'alexandra Püng. | Lectotypus ♂ | Y. Nekrutenko design. | 13.X.1983' (on yellow paper) — Nekrutenko (1984: 44, Pl. [1]; 1985: 30, fig. 2, a, b).

Paralectotypes ♂, 2♀:

- ♂, 2♀ with labels: printed, with handwritten (Püngeler) insertion 'Asia centr.[alis] | *Alexandergebirge* | *Rückbeil 1899*' (in white paper, in box) and handwritten (Püngeler) on printed

form 'Cotype <underlined> | *v. alexandra Püng.* ♂ (♀) | *Püngeler*' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Athamantis Ev. | v. Alexandra Püng.' (on white paper, in box).

alpina Staudinger, 1871

'*Lycaena Medon* Hufn. (*Agestis* S. V.) var *Alpina*' Staudinger, 1871b: 52. Type locality: not stated [Parnass?] — see also Staudinger, 1901: 83 for synonymy with 'ab. (et v.) *allous* Hb.'.

Types: not found; apparently they have never been designated.

alticola Christoph, 1893

'*Lycaena Coelestina* Ev. var. *Alticola*' Christoph, 1893: 86. Type locality: 'Urmus, Kasikoparan. Armeniae rossicae.'

Paralectotypes 4♂:

- ♂ with handwritten (Staudinger) labels 'Coelestina var. | Alticola | Christh.<sic>' (on white paper) and 'Urmus Cauc.[asus] m.[eridionalis] | Chr.[istoph] [18]83' (on green paper);
- 3♂ with circles of green locality label paper; one specimen has also a printed label 'Zool. Mus. | Berlin' (on pale yellow paper) and handwritten (Wagener) 'Lycaena | alticola Chr. | Urmus Cauc. m. | =Neolysandra | pontica Courv.' (on white paper), the second has a handwritten (Staudinger) label 'Urmus' (on green paper), the third — handwritten (Christoph?) 'L. Coelestina v. Alticola Chr.[istoph] | i. l.'

Lectotype designated by Nekrutenko *in* Hesselbarth *et al.*, 1995: 652 (deposited in Zoological Institute, Russian Academy of Sciences, St.-Petersburg, Russia). Since the forementioned specimens are undoubtedly an integral part of Christoph's type series forwarded to Staudinger, they are provided now as paralectotypes with a label '*coelestina alticola* | Christoph, 1893 | PARALECTOTYPUS | Y. Nekrutenko det. 11.11.1998' (on yellow paper) — ICZN Art. 74.1.3, Recommendation 74F.

amasina Neuburger, 1900

'*Lycaena menalcas* Frr. ♂ ab. *amasina*' Neuburger, 1900: 370. Type locality: 'Aus der Gegend von Amasia erhielt ich eine bedeutende Anzahl *Lycaena menalcas* Frr. Unter ihnen befand sich ein ♂, welches abweichende Merkmale trägt.'— Infrasubspecific.

Holotype ♂ (by monotypy):

- ♂ with labels: handwritten (Neuburger?) 'Lycaena menalcas | ab. amasina | Neubgr. Amasia' (on white paper, in printed box), printed 'Type' (on pink paper), handwritten (Forster) on printed form 'Agrodiaetus | dolus ♂ | menalcas Frr. | det W. Forster 1948' (on white paper) — cf. Häuser & Eckweiler (1997: 62).

The specimen is placed under a handwritten drawer label 'menalcas | ab. amasina | Neubgr.' (on white cross-lined notebook paper).

amor Staudinger, 1886

'*Lyc.*[*aena*] *Eros* Ochs. var. *Amor* Stgr.' Staudinger, 1886: 211. Type locality: 'Ich erhielt diese Lokalform von Eros in Anzahl aus dem Alai (südlich von Margelan gelegenen Gebirgen), von Osch, und von den Gebirgen bei Samarkand.' — Junior primary homonym and junior objective synonym of *Lycaena eros amor* Lang, 1884: 371.

Lectotype ♂:

- ♂ with labels: circle of brown paper, printed 'Origin.' (on pink paper), handwritten (Lukhtanov) on printed form 'Lectotypus ♂ | *amor Stgr.* design. *V. Lukhtanov*' (on white paper, recto red, verso white) — Lukhtanov & Lukhtanov (1994: 272).

Paralectotypes 11♂, 10♀:

- ♂ with labels: handwritten (Staudinger) 'Eros v. Amor | Stgr.' (on white paper), and 'Prov. Samark.[and] | Hbhr. [Haberhauer] [18]81' (on brown paper), small date label '6/7' (on white paper), printed 'Origin.' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten 'Polyommatus | amor Stgr. | typus (recto) | Gen. Prep. N 3092 ♂ (verso)'; (on white paper, in printed box);
- ♂ with labels: handwritten (Staudinger) 'circa Napaea ♂ | GrGr', a circle of brown locality label paper, small date label '6/7' (on white paper), and printed 'Origin.' (on pink paper);

- ♂ with labels: handwritten (Staudinger) 'oben genau wie Erigone | Gr.-Gr. | die unten auf Htfl. | deutlicheren weissen Längsst[rich?] u. rothen Randaugen hat' (on white lined notebook paper), circle of brown locality label paper, small date label '6/7' (on white paper), and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Margelan | Hbhr. [Haberhauer]', small date label '2/7' (on white paper), and printed 'Origin.' (on pink paper);
- 3♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper);
- ♂ with labels: handwritten (Staudinger) 'Eros v. Amor | Stgr.' (on white paper), handwritten label 'Alai | [18]85 Hb. [Haberhauer]', and printed label 'Origin.' (on pink paper);
- ♂, 3♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper); one female specimen has a handwritten label 'Lyc.[aena] Eros | 3000 m';
- ♂ with labels: handwritten (Staudinger) 'Eros v. Amor | Stgr.' (on white paper), 'Margelan | Maur.[er] [18]84', and printed label 'Origin.' (on pink paper);
- ♂, 3♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper); the male specimen also has a handwritten date label '27/6' (on white paper) and a handwritten label 'Kara Karek' (on white paper);
- ♂ with labels: handwritten 'Osch | Hbhr. [Haberhauer]' and printed 'Origin.' (on pink paper);
- 2♂, ♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper); one male specimen also has a small date label '19/7' (on dirty white paper).

amurensis Staudinger, 1892

'*Polyommatus Hippothoë* L. var. *Amurensis* Stgr.' Staudinger, 1892b: 155. Type locality: 'Die mir vorliegenden 3 Pärchen vom Uss.[uri] (1 ♀ von Radd.[efka]) berechtigen…'

Syntypes 3♂, 3♀:

- ♂ with labels: handwritten (Staudinger) 'v. Amurensis | Stgr.' (on white paper), handwritten 'Sutschan | [18]90 Dörr.[ies]' (on bluish-violet paper), printed 'Origin.' (on pink paper);

- ♂, ♀ with circles of bluish-violet locality label paper and printed label 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Ussuri | Dörr.[ies] [18[82]' (on bluish-violet paper) and printed 'Origin.' (on pink paper);
- ♀ with circle of bluish-violet locality label paper and printed label 'Origin.' (on pink paper);
- ♀ with labels: handwritten 'Raddefskaja | Chr.[istoph]' (on bluish-violet paper), small handwritten labels '14/7 [18]76' and '11/7' (on white paper) and printed 'Origin.' (on pink paper).

amurensis Staudinger, 1892

'*Lycaena Amanda* Schn. var. *Amurensis* Stgr.' Staudinger, 1892b: 162. Type locality: 'Von Radde im Bur.[eja]-G.[ebirge], von Maack am Uss.[uri] gefangen. Christoph fand diese Art im Juli bei Radd.[efka] nicht selten; Dörries sandte sie mir von Ask.[old], Baran.[owka], vom Sutschan und vom Uss.[uri]; Graeser fand sie bei Chab.[arowka] selten, bei Pokr.[ofka] ziemlich häufig'.

Syntypes 5♂, ♀:

- ♂ with labels: handwritten (Staudinger) 'v. Amurensis | Stgr.' (on white paper), and 'Raddefskaja | Chr.[istoph] [18]84' (on violet paper), printed 'Origin.' (on pink paper);
- ♂, ♀ with circles of violet locality label paper and printed label 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Ussuri | Dörr.[ies] [18]82' (on violet paper), printed 'Origin.' (on pink paper);
- ♂ with circles of violet locality label paper and printed label 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Baranowsky | Dörr.[ies]' (on violet paper), printed 'Origin.' (on pink paper).

Another ♂, ♀ from 'Sutschan | [18]90 Dörr[ies]' and ♂, ♀ from 'Askold | Dör.[ries]' are not designated as 'Origin.' though they fit all requirements to be syntypes.

ankara Schurian & Hofmann, 1983

'*Lysandra ankara* sp. nov.' Schurian & Hofmann, 1983: 121. Type locality (holotype): 'Anatolia/Ankara, vic. Kizilçahamam, 5 km südlich, 1100–1400 m...'

Paratype ♂:

- ♂ with labels: printed, with handwritten (Schurian) insertion 'ANATOLIA/Ankara | vic. Kizilçahamam | 5km <sic> südl./nördl. <sic> | 1100-1400 m NN | leg. Schurian | *30.VII.*[19]*77*' (on white paper) and handwritten (Schurian) on printed form 'PARATYPUS ♂ | *Lysandra* | *ankara sp. n.* | det. Schurian/*Hofmann* 1*983*' (on red paper, in box).

antidolus Rebel, 1901

'*Lycaena Dolus* Hb. var. *Antidolus* n. var.' Rebel, 1901: 167. Type locality: '...am Takaltu Dagh bei Kulp (Russ.[isch]-Südarmenien) um den 15. Juli 1901...' 'Die Typen befinden sich im k. k. naturhistorischen Hofmuseum und in der Sammlung des Herrn Bohatsch'.

Paralectotype ♂:

- ♂ with labels: handwritten 'Lyc.[aena] dolus Hb. | v. Antidolus Rbl. <in black ink> | Type 1902 <in red ink>' (in white paper), handwritten (Püngeler) 'Armenia | (Kasikoparan) | Gebirgsthäler, Korb 15.7.[19]01 (recto) | v. antidolus Rbl. ♂ | Type <double underlined> ex coll. Bohatsch | 12/1912 M. Korb Püngeler (verso)' (on white paper), handwritten (Püngeler) on printed form 'Type <double underlined> | *v. antidolus Rbl.* ♂' (on pink paper), handwritten (Forster) on printed form '*Agrodiaetus* ♂ | *antidolus Rebel* | det. W. Forster 1*948*' (on white paper) handwritten (Forster) on printed form 'Para-Typus ♂ | *Lycaena dolus* | *antidolus Rebel*' (on pink paper) — Forster (1961: 111); cf. Häuser & Eckweiler (1997: 63).

The specimens are placed under a handwritten (Püngeler) drawer label 'Dolus Hb. | v. Antidolus Rbl.' (on white paper, in printed box).

antiochena Lederer, 1861

'*Lycaena antiochena* m.' Lederer, 1861: 148, Taf. 1, Figs 2, 3. Type locality: 'Bei Antiochia. ...erhielt ich nur 4 ♂ und 3 ♀'.

Syntypes ♂, ♀:

- ♂, ♀ with labels: handwritten 'Antiochia' (on white paper), printed 'Coll. Led.' (on white paper) and printed 'Origin.' (on pink paper).

The specimens are placed under a handwritten drawer label 'Antiochena | Ld.' (on white paper, in box).

antiqua Staudinger, 1900

'*Lyc*[*aena*] *Chiron* Hufn. var. (Antiqua)' Staudinger, 1900: 334. Type locality: 'aus dem östlichen Thian Schan-Gebiet'.

Syntypes 9♂, 5♀:

- ♂ with labels: handwritten (Staudinger) 'v. Antiqua' (on white paper), and 'Thian or.[ientalis] [18]96 | Hbh. [Haberhauer]' (on brown paper) and printed 'Origin.' (on pink paper);
- ♂ with circles of brown locality label paper and printed 'Origin.' (on pink paper);
- ?-♂ with labels: handwritten (Staudinger) 'v. Antiqua | Stgr. in l. | (recto) | v. Cogistana ? (verso)' (on white paper) and 'Usgent | Hbh. [Haberhauer] [18]83' (on brown paper);
- ?-♂ with handwritten label 'Osch | Hbh. [Haberhauer] [18]80' (on brown paper);
- ?-♂ with handwritten label 'Alai | [18]85 Hbh. [Haberhauer]' (on brown paper);
- ?-2♂ with circles of brown locality label paper;
- ?-♀ with handwritten label 'Namangan | 18[84] Hbhr. [Haberhauer]' (on brown paper).
- ?-♂, ♀ with labels: printed 'Korla' (on white paper), the male specimen has a handwritten (Staudinger) label 'Chiron v. | Antiqua' (on white paper);
- ?-♂ with labels: handwritten (Staudinger) 'v. Antiqua | Stgr.' (on white paper), and 'Alex.[ander] Geb.[irge] | [18]86 Hbh. [Haberhauer]' (on brown paper);
- ?-♀ with circles of brown locality label paper;
- ?-♂ with handwritten label 'Prov. Samark.[and] | Hbhr. [Haberhauer] [18]81' (on brown paper);
- ?-♀ with circles of brown locality label paper;

Of these specimens, only two males are designated as 'Origin.[ale]' though they all originated from Central Asia and

hence may belong to the type series and should be considered syntypes: '...wie andere mir vorliegende centralasiatische aus dem Fergana-Gebiet... Wir versandten die centralasiatischen Stücke als var. Antiqua.' (*op. cit.*: 334).

aquilina Staudinger, 1901

'*Lycaena* F. *Orbitulus* Prun. v. *Aquilina* Stgr.' Staudinger, 1901: 81. Type locality: 'Lap.[ponia]'.

Syntypes 6♂, 4♀:

- ♂ with handwritten label 'Lapponia | Keit.[el]' (on pale bluish paper);
- 2♂, 2♀ with circles of pale bluish locality label paper;
- ♂ with handwritten (Staudinger) label 'Finmarken | Schm.[?]' (on white paper);
- 2♂, 2♀ with circles of white locality label paper.

Likewise most of the Staudinger species-group taxa becoming available after his death in 1900 (i. e. in Staudinger, 1901), the type specimens were not designated with characteristic 'Origin.' labels. Since there are no other specimens determined as *aquilina* Stgr. in the collection, and since the specimens above are placed under the handwritten drawer label 'v. Aquilina Stgr. | Aquila Auriv.[illius]' (on white paper, unknown hand, in pencil) and because of the same type locality stated on the label and in the original description, they are accepted here with confidence as syntypes and provided with a printed label '*aquilina* Staudinger, 1901 | SYNTYPUS | Y. Nekrutenko det. 3.11.1998' (on yellow paper).

araxiana Koçak, 1980

'*Agrodiaetus* (*Sublysandra*) *myrrhus araxiana* n. subsp.' Koçak, 1980b: 266, Figs 6–9. Type locality: 'Türkei, Kars, Akçay 1500–1700 m'.

Paratypes 3 ♂:

- 3♂ with labels: printed 'Türkei/Kars | Akçay | 1500-1700 m | 22.7.[19]77 | leg. Eckweiler' (on white paper), handwritten (Koçak) on printed form 'PARATYPUS ♂ | *Agrodiaetus* | *(Sublysandra)* | *myrrha araxiana* | *KOÇAK 1979*' (on red paper) — cf. Häuser & Eckweiler (1997: 109).

ardschira Brandt, 1938

'*Lycaena ardschira sp. n.*' Brandt, 1938: 672, Taf. 4, Figs 6–8. Type locality: Iran, 'Comèe, 2600 m'.

Paratype ♂:

- ♂ with labels: printed 'Iran Fars | Straße Ardekan - Talochsroe | Comèe ca 2600 m 1937 | coll. Brandt' (on yellow paper), printed '61.' (on white faded paper), printed 'Paratypus' (on red paper) and handwritten 'Lycaena | ardschira B.[randt]' (on white paper) — cf. Häuser & Eckweiler (1997: 63).

argiva Staudinger, 1886

'*Lyc.*[*aena*] *Argiva* Stgr. (Argus var.?)' Staudinger, 1886: 204. Type locality: 'Von dieser Art (oder Localform) besitze ich 3 ♂ and 1 ♀ aus dem Alai, 2 ♂ und 1 ♀ aus 'Margelan', die auch wohl aus dem südlich davon gelegenen Alai-Gebirge stammen, und ein ♂, welches am 10. Mai bei Namangan gefunden wurde'.

Syntypes 6♂, 3♀:

- ♂ with labels: handwritten (Staudinger) 'Argiva Stgr.' (on white paper), handwritten 'Alai | [18]85 Hbh.[Haberhauer]' (on brown paper), printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Alai | [18]85 Hbh.[Haberhauer]' (on brown paper) and printed 'Origin.' (on pink paper);
- ♂, ♀ with circles of brown locality label paper and printed 'Origin.' (on pink paper);
- 2♂, 2♀ with labels: handwritten 'Margelan | Maur.[er] [18]84' (on brown paper) and printed 'Origin.' (on pink paper); one ♂ and one ♀ with handwritten (Staudinger) label 'wie Roxane ♂ (♀) Gr. Gr.' (on white paper);
- ♂ with labels: handwritten (Staudinger) 'Argus var.? | Argiva Stgr.' (on white paper), handwritten 'Namangan | Hbh.[Haberhauer] [18]84' (on brown paper), printed 'Origin.' (on pink paper).

arionides Staudinger, 1887

'*Lycaena Arionides* Stgr.' Staudinger, 1887b: 141, Taf. 7, Fig. 1, a–c. Type locality: 'Christoph fing diese schöne Art Ende Juli, Anfang August bei Wladiwostok; Dörries sandte sie mir später noch in einiger Anzahl vom Ussuri ein.'

Syntypes 9♂, 5♀:

- ♂ with labels: handwritten (Staudinger) 'Arionides | Stgr.' (on white paper), handwritten 'Ussuri | Dörr.[ies]' (on violet-blue paper) and printed 'Origin.' (on pink paper);
- ♂, 2♀ with circles of violet-blue locality label paper and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Wladiwostock | Chr.[istoph]' (on violet-blue paper), small date label '9/8' (recto white, verso red) and printed 'Origin.' (on pink paper);
- 6♂, 3♀ with circles of violet-blue locality label paper, some with small date labels as above, and printed 'Origin.' (on pink paper).

armena Rebel, 1901

'*Thecla Myrtale* Klug var. *Armena* n. var. ♂ ♀' Rebel, 1901: 165. Type locality: '...anfangs Juli 1901 in einem Flussthale bei Kasikoparan (Russ.[isch]-Armenien, südlich von Kars gelegen)...' 'Mir liegen zur Beschreibung zwei Pärchen vor: eines aus der Sammlung des k. k. naturhistorischen Hofmuseum, das andere aus jener des Herrn Bohatsch'.

Syntypes ♂, ♀:

- ♂, ♀ with labels: printed 'Russ.[ische] Armen.[ien] | Kasikoparan | 1901 Korb' (on white paper) and handwritten (Püngeler) on printed form 'Cotype <underlined> | *v. armena Rbl.* ♂ (♀) | *von M. Korb* | *Püngeler*' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Myrtale Klug | v. Armena Rbl' (on white paper, in printed box).

armena Staudinger, 1871

'*Lycaena Hylas* Esp. v. *Armena*' Staudinger, 1871a: 12. Type locality: 'Arm.[enia]'.

Lectotype ♂:

- ♂ with labels: handwritten 'Achalzich' (on white faded paper), printed 'Coll. Led.' (on white paper) and 'Origin.' (on pink paper), 'Zool. Mus. | Berlin' (on pale yellow paper), printed,

with handwritten (Wagener, in pencil) insertions 'Abgebildet in Hesselbarth, | van Oorschot & Wagener: | Tagfalter der Türkei | Tafel *106* Figur *41*' (on white paper), handwritten (Nekrutenko) on printed form 'LECTOTYPUS ♂ | *armena Stgr.* | Y. Nekrutenko design.' (on yellow paper) — Nekrutenko *in* Hesselbarth *et al.* (1995: 658, Taf. 106, Fig. 33).

Paralectotypes, 2♂, ♀:

- ♂ with labels: handwritten 'Achalzich' (on white faded paper), printed 'Coll. Led.' (on white paper) and 'Origin.' (on pink paper), 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Nekrutenko) on printed form 'PARALECTOTYPUS ♂ | *armena Stgr.* | Y. Nekrutenko design.' (on yellow paper);
- ♂ with labels: handwritten 'Caucasus | Hbhr. [Haberhauer]' (on green paper) and printed 'Origin.' (on pink paper), handwritten (Nekrutenko) on printed form 'PARALECTOTYPUS ♂ | *armena Stgr.* | Y. Nekrutenko design.' (on yellow paper);
- ♀ with labels: handwritten 'Achalzich' (on white faded paper), printed 'Coll. Led.' (on white paper) and 'Origin.' (on pink paper), 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Nekrutenko) on printed form 'PARALECTOTYPUS ♂ (♀) | *armena Stgr.* | Y. Nekrutenko design.' (on yellow paper), printed, with handwritten (Wagener, in pencil) insertions 'Abgebildet in Hesselbarth, | van Oorschot & Wagener: | Tagfalter der Türkei | Tafel *106* Figur *40*' (on white paper).

armeniaca A. Bang-Haas, 1906

'*Chrysophanus virgaureae* v. *armeniaca* n. var.' Bang-Haas, A. 1906: 128. Type locality: 'Eine Anzahl ♂♂ aus Armenien (Tschorum)...' — Junior subjective synonym of *Papilio virgaureae virgaureae* Linnaeus, 1758 (Hesselbarth *et al.*, 1995: 470).

Lectotype ♂:

- ♂ with labels: handwritten (A. Bang-Haas?) 'Chrys.[ophanus] Virg.[aureae] | v. Armeniaca | B-H | Tschorum Armen.[ien]' (on white paper) and printed 'Origin.' (on pink paper). Designated with a handwritten label on printed form 'LECTOTYPUS ♂ | *armeniaca A. B.-H.* | Y. Nekrutenko design.' (on yellow paper) — Nekrutenko *in* Hesselbarth *et al.* (1995: 470).

Paralectotype ♂:

- ♂ with printed label 'Origin.' (on pink paper). Designated with a handwritten label on printed form 'PARALECTOTYPUS ♂ | *armeniaca A. B.-H.* | Y. Nekrutenko design.' (on yellow paper).

arsacia Lederer, 1869

'*Lycaena Panagaea* H. Sch. Var. *Arsacia* Led.' Lederer, 1869: 78, Taf. 4, Fig. 9). Type locality: '...bei Astrabad in Persien... Um Astrabad fand er [Haberhauer] nur wenige Lepidopteren, dagegen zeigten sich Hadschyabad und Schaku, 120 Werste davon entfernt, reich daran' (op. cit.: 73). — Junior subjective synonym of *Lycaena anisophthalma* Kollar, 1849 (Staudinger, 1901: 80).

Syntypes 3♂, ♀:

- ♂ with labels: handwritten 'Lycaena | Arsacia', 'Astrabad' (both on white paper) and printed 'Origin.' (on pink paper);
- ♂, ♀ with labels: handwritten 'Hadschyabad' (on white paper) and printed 'Coll. Led.' (on white paper);
- ♂ with printed label 'Coll. Led.' (on white paper).

The specimens are provided now with a printed label: '*arsacia* | Lederer, 1869 | SYNTYPUS | Y. Nekrutenko det. 3.11.1998' (on yellow paper).

asabinus Herrich-Schäffer, [1851]

'[*Polyommatus*] *Asabinus*' Herrich-Schäffer, [1851] **1**(49): Tab. 109, Figs 527, 528; '*Helius* Kad.' [1852] **6**(55): 32. Type locality: 'Aus Kleinasien.'

Types: not found.

astraea Freyer, [1851]

'*Lycaena Pap.*[*ilio*] *Astraea*' Freyer, [1851] **6**(98): 161, Tab. 583, Figs 1, 2. Type locality: 'Von Herrn Kindermann unter obigen Namen mir zugesendet. Bei Amasia'.

Syntypes ♂, ♀:

- ♂ with labels: handwritten 'Astraea | Frey.[er] h.<n.[euere]?> Beitr.[äge] t. 583 | Led. | Amasia Kind.[ermann]' (recto yellow, in printed box, verso white), printed '4679' (on white paper);
- ♀ without any label.

Catalogus Generalis: 4679 — see Appendix.

The specimens are provided now with a printed label '*astraea* Freyer, [1851] | SYNTYPUS | Y. Nekrutenko det. 7.12.1998' (on yellow paper).

aurantiaca Staudinger, 1901

'*Thestor* Hb. *Nogelii* HS. v. (et ab.) *Aurantiaca* Stgr.' Staudinger, 1901: 72. Type locality: 'As.[ia] min.[or] (Kaisarie); Ant.[iochia] (Aintab)'.— Junior subjective synonym of *Thestor nesimachus* Oberthür, 1893.

Syntypes 6♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'v. Aurantiaca | Stgr.' (on white paper, glued to a larger piece of paper and then pinned to the specimen), handwritten 'Kaiserie <sic> | [18]86 Man.[issadijan]' (on yellow paper) and small handwritten date label '1/6' (on white paper);
- ♀ with a circle of yellow locality label paper, small date label '15/5' (on yellowish paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), printed 'Paratypus' (on red paper), handwritten '8.6 Mann | Kaiserie' (on white paper), handwritten 'Thestor nogelii | aurantiaca Stgr.' (on white paper) and printed, with handwritten (Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *92* Figur *50*' (on white paper);
- ♂ (abdomen removed), with labels: printed 'Zool. Mus. | Berlin' (on pale yellow paper), printed 'Paratypus' (on red paper), handwritten 'Kaiserie' (on white paper), handwritten 'Thestor nogelii | aurantiaca Stgr.' (on white paper) and printed, with handwritten insertion'Genit.-Unters. | Nr. *202* | Zool. Mus. Berlin' (on white paper);
- 4♂, ♀ with a circle of yellow locality label paper, three male specimens also have small date labels '12/5' and '29/5' (on yellowish paper) and '1/6' (on white paper); last one has also labels: printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Wagener) 'Thestor nogelii | aurantiaca Stgr. | [18]'86 Mann. Kaiserie' (on white paper) and printed, with handwritten (Wagener) insertions 'Abgebildet in Hesselbarth |

van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *92* Figur *36*' (on white paper).

aureomicans Heyne, 1897

'*Polyommatus virgaureae* L. nov. var. *aureomicans*' Heyne, 1897: 9. Type locality: 'Fluggebiet: Mersina (südliches Kleinasien, Taurus)'.

Syntypes ♂, ♀:

- ♂ with labels: handwritten 'Hadjin' (on white paper), handwritten '7/95' (on white paper), handwritten (Püngeler) 'als aureomicans | ♂ 5/1912 v.[om] Bartel | Püng.[eler]' (on white paper) and handwritten (Püngeler) on printed form 'Cotype <underlined> | *v. aureomicans Heyne* ♂ | *Püngeler*' (on pink paper);
- ♀ with labels: handwritten (Püngeler) 'Taurus | (Mersina) | Heyne (recto) | v. aureomicans ♀ | Cotype <underlined> | ex coll. Bernard | 3.[19]09 v.[om] M. Bartel (verso)' (on white paper) and handwritten (Püngeler) on printed form 'Cotype <underlined> | *v. aureomicans Heyne* ♀ | *Püngeler*' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Virgaureae L. | v. Aureomicans Heyne' (on white paper, in printed box).

bella Herrich-Schäffer, [1844]

'*Lycaena Bella*' Herrich-Schäffer, [1844] **1**(7): Tab. 49, Figs 227, 228; [1845] **1**(10): 127. Type locality: 'Ein Mannchen erhielt Hr. Bischoff aus der Gegend von Brussa'.— Junior subjective synonym of *Papilio argus aegidion* Meisner, 1818. Infrasubspecific.

Types: not found.

bellus Kardakoff, 1928

'*Zephyrus taxila* Brem. f. ♂ *bellus* (nom. coll.)' Kardakoff, 1928: 271, Taf. 7, Fig. 15. Type locality: '...aus dem Ussurigebiet...' — Infrasubspecific.

Syntype ♂:

- ♂ with labels: printed, with handwritten (Kardakoff?) insertion 'Narva, S. Ussurigebiet | *5.8.* [19]*21.* N. Kardakoff' (on white

paper), handwritten (Kardakoff?) 'Zephyrus taxila Brem L. | f. ♂ bellus Kardakoff' (on white paper) and printed 'Typus' (on red paper, in box).

The specimens are placed under a typewritten drawer label 'f. ♂ bellus' <underlined with red pencil> (on a stripe of white paper, in blue type ribbon).

berber Le Cerf, 1932

'*Lycaena coridon* Poda ssp. *berber*, nova' Le Cerf, 1932: 163. Type locality: 'Types : ♂♂ et ♀♀ (1 ♂ H.[olo-] T.[ype]), Maroc, Moyen Atlas: Daya Chikker, Ksar el Kebir, Timesmount, Tameghilt, Moussah ou Salah, de 1.500 à 3.000 m., 10 au 26-VIII-1930. Le mâle «Holotype» est de Ksar el Kebir.'

Paratypes ♂, ♀:

- ♂ with labels: handwritten (Le Cerf?) on printed form '*Lyc.*[*aena*] *coridon* | *ssp. berber* | ♂ *Cotype Le Cerf* | Coll. F. Le Cerf', handwritten (Le Cerf?) 'Maroc | Moyen Atlas | Ksar el Kebir | 20/25-VIII-1930 | F. Le Cerf' and printed 'COTYPE' (on white paper, in red ink);
- ♀ with labels: handwritten (Le Cerf?) on printed form '*Lyc.*[*aena*] *coridon* | *ssp. berber* | ♀ *Cotype Le Cerf* | Coll. F. Le Cerf', handwritten (Le Cerf?) 'Maroc | Moyen Atlas | Ksar el Kebir | 20/25-VIII-1930 | F. Le Cerf' and printed 'COTYPE' (on white paper, in red ink).

betulina Staudinger, 1887

'*Thecla Betulina*' Staudinger, 1887b: 127, Taf.16, Fig. 6. Type locality: '...nur zwei Männchen, welche von Dörries am Suifun, an Apfelbäumen fliegend, gefangen wurden'.

Syntypes 2♂:

- ♂ with labels: handwritten (Staudinger) 'Betulina | Stgr.' (on white paper), handwritten 'Suifun | [18]85 Dörr.[ies]' (on violet-blue paper) and printed 'Origin.' (on pink paper);
- ♂ with circle of violet-blue locality label paper, handwritten label '474.' and printed 'Origin.' (on pink paper).

birunii Eckweiler & ten Hagen, 1998

'*Polyommatus (Agrodiaetus) posthumus birunii* subspec. nov.' Eckweiler & ten Hagen, 1998: 116, Abb. 13–16. Type locality (holotype): 'Iran, Tehran, Elburs-Gebirge 15 km E Firuzkuh (Paß), 2400 m'.

Paratype ♂:

- ♂ with printed labels: 'Iran, Tehran | Elburs-Geb. 15 km E | Firuzkuh (Paß) | 2300–2400 m | 18.VII.1997 | leg. W. ten Hagen' (on white paper). Designated with a printed label '**Paratypus** | *Polyommatus (Agrodiaetus)* | *posthumus* ***birunii*** subspec. nov. | des. Eckweiler & ten Hagen 1998' (on bluish paper, in box).

bitonides Staudinger, 1871

'*Lycaena Biton* Brem. (an 'Bitonides' nominandus?)' Staudinger, 1871a: 13. Type locality: 'Daür. [Dahuria]; Amur' (see also Staudinger, 1892b: 163). — nomen nudum.

Types: not found.

boisduvalii Herrich-Schäffer, [1843]

'*Lycaena Boisduvalii*' Herrich-Schäffer, [1843] **1**(1): Tab. 2, Figs 7–9; [1844] **1**(9): 121. Type locality: 'Aus dem südlichen Russland' — Junior subjective synonym of *Lycaena eroides* Frivaldszky, 1835.

Types: not found.

borussia Dadd, 1909

'*Lycaena corydon borussia*' Dadd, 1909a: (1xiii); 1909b: (36). Type locality: '...a form from Berlin... The same form is reported by Herr Zobel from Osterode, East Prussia...'

Neotype ♂:

- ♂ with labels: handwritten 'Nieder- | finow [bei Eberswalde, DDR], 22.7.1982, | [leg.] Dr. Kames' (on white paper, in pencil), handwritten (Schurian) 'Polyommatus (Ly- | sandra) coridon | borussia Dadd (1909) | det. Schurian 1989' (on white paper), on printed form with handwritten (Schurian) insertion '*Neo-* Typus | ♂' (recto red, verso white), handwritten (Schurian) 'Neotypus ♂ | Lycaena corydon | borussia Dadd 1909 | design. Schurian, 1989' (recto red, verso white) — Schurian (1989: 305, Abb. 1).

brevicaudis Vorbrodt, 1912

'*Thecla* F. *linceus* Esp. (=*spini* Schiff.) *brevicaudis* Püngeler i. l.' Vorbrodt, 1912: 106. Type locality: 'Zermatt, in etwa 40 Stücken erzogen'.

?-Syntypes 4♂, 4♀:

- ♂ with labels: printed, with handwritten (Püngeler) insertion 'Zermatt | *Rhamnus alpina* | *Püng.*[eler] *e*[x] *l.*[arva] *fin.*[e] *7.1907*' (on white paper) and handwritten (Püngeler) on printed form 'Type <double underlined> | *v. brevicaudis Püng.*[eler] | ♂' (on pink paper);
- 3♂, 4♀ with same printed labels with dates of 'fin. 7.1901' and 'fin. 7.1908' (all ex larvae) and handwritten (Püngeler) on printed form 'Cotype <underlined> | *v. brevicaudis Püng.*[eler] | ♂ (♀)' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Spini Schiff. | v. Brevicaudis Püng.' (on white paper, in printed box).

brillantina Staudinger, 1887

'*Thecla Brillantina* Stgr.' Staudinger, 1887b: 130, Taf. 6, Fig. 3, a, b, c. Type locality: '...erhielt ich nur von der Insel Askold und vom Suifun durch Dörries in einer grösseren Anzahl meist gezogener Stücke'.

Syntypes 5♂, 5♀:

- ♂ with labels: handwritten (Staudinger) 'Brillantina | Stgr.' (on white paper), handwritten 'Suifun | [18]85 Dörr.[ies]' (on bluish paper), printed 'Origin.' (on pink paper);
- ♀ with circle of bluish locality label paper and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Askold | [18]83 Dörr.[ies]' (on bluish paper) and printed 'Origin.' (on pink paper);
- 3♂, 4♀ with circle of bluish locality label paper and printed 'Origin.' (on pink paper); one ♀ also has a handwritten label '12' (on white paper).

caerulea Staudinger, 1871

'*Lycaena Damon* Schiff. ab. ♀ (et v.?) *Caerulea*; Damone ♀ var. Ld. Hor. l. c. T. IV, 8; var. intermedia Iphigeniae et Damonis Ld. l. c. (♀ caerul., ♂ marg. lato nigro).' Staudinger, 1871a: 13. Type locality: 'Hyrc.[aniae] alp.[es]'.

Syntypes 5♂, 9♀:

- ♀ with labels: handwritten 'Hadschyabad' (on white faded paper), printed, with handwritten insertion '*Damone* | Coll. Led.' (on white paper), printed 'Origin.' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Wagener, in ball pencil), handwritten 'caerulea' (on white paper);
- ♀ with labels: handwritten 'Hadschyabad' (on white faded paper), printed, with handwritten insertion '*Damone* | Coll. Led.' (on white paper), printed 'Origin.' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Wagener) 'Lycaena | caerulea | Stgr' (on white paper) handwritten '27' (on white notebook cross-lined paper), printed, with handwritten (Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *121* Figur *57*' (on white paper);
- ♂ with labels: handwritten 'Hadsch.[yabad] | Hbhr. [Haberhauer]' (on yellow paper), printed 'Origin.' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Wagener) 'Lycaena | caerulea | Stgr.' (on white paper), handwritten '26' (on white notebook cross-lined paper), printed, with handwritten (Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *121* Figur *56*' (on white paper);
- ♀ with labels: handwritten 'Hadsch.[yabad] | Hbhr. [Haberhauer]' (on yellow paper), printed 'Origin.' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Wagener) 'Lycaena | caerulea | Stgr.' (on white paper), printed, with handwritten (Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *121* Figur *58*' (on white paper);

- ♂ with labels: handwritten 'Schahkuh | Chr.[istoph]' (on yellow paper), printed 'Origin.' (on pink paper), handwritten date label '18/5' ('18' on white, 'V' on pink background, recto white/pink, verso pink);
- ♂ with circle of yellow locality label paper, printed 'Origin.' (on pink paper), handwritten date label '18/V' ('18' on white, 'V' on pink background, recto white/pink, verso pink);
- ♀ with circle of yellow locality label paper, printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Wagener) 'Schahkuh' (on white paper), handwritten (Wagener in ball pencil) 'caerulaea | Berlin' (on white paper), printed, with handwritten (Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *121* Figur *59*' (on white paper);
- 2♂, 4♀ with circle of yellow locality label paper and small Christoph's date labels. — ♀ above and these specimens undoubtedly belong to the type series though not provided with Staudinger's 'Origin.' labels (cf. Hesselbarth *et al.*, 1995: 728, Taf. 121, Fig. 56–60; Häuser & Eckweiler, 1997: 68);
- ♀ with labels: handwritten (Püngeler) 'Hyrcania (recto) | als caerulea ♀ | vom Stgr (verso)' (on white paper, recto in printed box), handwritten (Püngeler) on printed form 'Cotype <underlined> | *v. caerulea Stgr.* ♀ | *vom Autor.* | *Püngeler*' (on pink paper) — cf. Häuser & Eckweiler (1997: 68).

caerulescens A. Bang-Haas, 1912

'*Callophrys rubi* v. *caerulescens* n. var.' Bang-Haas, A., 1912: 106. Type locality: 'Aus dem Kaukasus (Elisabethpol).' — Junior subjective synonym of *Callophrys rubi chalybeitincta* Sovinsky, 1905 (Hesselbarth *et al.*, 1995: 516).

Lectotype ♂:

- ♂ with labels: handwritten (O. Bang-Haas – sic) 'Callophrys | Rubi | v. Caerulescens | B[ang] H[aas]' (on white paper), printed 'Elisabethpol | Kaukasus' (on white paper) and printed 'Origin.' (on pink paper), handwritten (Nekrutenko) on printed form 'LECTOTYPUS ♂ | *caerulescens O.*<sic! recte *A.*> *B.-H.* | Y. Nekrutenko design.' (on yellow paper) — Nekrutenko *in*

Hesselbarth *et al.* (1995: 516), handwritten (Wagener) '= chalybeitincta Sovinsky' (on white paper, in ball pencil).

Paralectotypes ♂, ♀:

- ♂ with labels: printed 'Elisabethpol | Kaukasus' (on white paper) and printed 'Origin.' (on pink paper), handwritten (Nekrutenko) on printed form 'PARALECTOTYPUS ♂ | *caerulescens O.* <sic! recte *A.*> *B.-H.* | Y. Nekrutenko design.' (on yellow paper);
- ♀ with labels: printed 'Elisabethpol | Kaukasus' (on white paper) and handwritten (Püngeler) 'v. caerulescens ♀ | 1/1914 v.[om] B-Haas | Püng.[eler]'.

The specimens are placed under handwritten (Püngeler) drawer label 'Rubi L. | ab. Caerulescens Courv.' (on white paper, in printed box).

cala Strand, 1919

'*Lycaena semiargus* Rott. ab. *cala* m.' Strand, 1919: 18. Type locality: 'Marburg.' — Infrasubspecific.

Holotype ♂ (by monotypy):

- ♂ with labels: printed 'Deutschland | Marburg i.[n] H.[essen] | E. Strand, [190]8.' (on white paper), handwritten (Strand) on printed form '*Lycaena* | *semiar-* | *gus Rott.* | *ab. cala m.* ♂ | Strand det.' (on white paper) and printed 'Type' (on dirty-pink paper).

candalus Herrich-Schäffer, [1851]

'[*Lycaena*] *Candalus*' Herrich-Schäffer, [1851] **1**(49): Tab. 105, Figs 502–505; [1852] **6**(55): 26–27. Type locality: 'Aus Kleinasien'.

Types: not found.

candens Herrich-Schäffer, [1844]

'*Polyommatus candens*' Herrich-Schäffer, [1844] **1**(7): Tab. 49, Figs 229–231; [1847] **1**(26): Tab. 73, Fig. 355; '*Polyommatus Candens*' Bischoff [1845] **1**(10): 133. Type locality: 'Ein Pärchen erhielt Hr. Bischoff aus Kleinasien'.

Types: not found.

carmon Herrich-Schäffer, [1851]

'[*Lycaena*] *Carmon* Kad.' Herrich-Schäffer, [1851] **6**(48): 24; [1851] **1**(49): Tab. 105, Figs 506, 507. Type locality: 'Ein Mann von Herr Kaden aus Kleinasien'.

Type (holotype by monotypy): not found (cf. Häuser & Eckweiler, 1997: 68).

caspius Lederer, 1869

'*Polyomm.*[*atus*] *Caspius* Led.' Lederer, 1869: 76, Taf. 4, fig. 3. Type locality: '...bei Astrabad in Persien...' (*op. cit.*: 73).

Holotype ♂ (by monotypy):

- ♂ with labels: handwritten 'Hadschyabad' and (Lederer?) 'Polyomat.[us] <sic> | Caspius' (both on white paper), printed 'Origin.' (on pink paper) and 'Coll. Led.' (on white paper).

There are one more male and one female specimen with similar locality labels but without 'Coll. Led.' labels provided by Staudinger with printed 'Origin.' Since Lederer clearly declared 'Ich erhielt nur dies eine Exemplar' (*op. cit.:* 77), only one of these, belonging to Lederer, is *de facto* a type; other specimens subsequently considered by Staudinger as 'Origin.[ale]', i. e. 'types', have no nomenclatural status.

The specimen is provided now with a printed label '*caspius* Lederer, 1869 | HOLOTYPUS | (par monotypiam) | Y. Nekrutenko det. 26.10.1998' (on red paper).

caucasica Lederer, 1870

'*Lycaena Corydon* Scop. Var. *caucasica* Led. (*Polona* Led. Wien. Ent. Mtsch. T. VIII, p. 166, non Z.)' Lederer, 1870a: 23. Type locality: not stated.

Neotype ♂:

- ♂ with labels: handwritten 'Caucas[us]' (on white faded paper), printed 'Coll. Led.' (on white paper), printed 'Origin.' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Schurian) on printed lined form '*Polyommatus* | *(Lysandra)* | *corydonius cauca-* | *sicus LED., 1870* | *det. Schurian* 1988' (on white paper), handwritten (Schurian) '*Neotypus* ♂ <written over printed 'Paratypus'> | *Lycaena* |

corydonius caucasica | *LEDERER 1870* | det. Schurian, 1988' (on red paper, in box) — Schurian (1988: 139).

caudatus Staudinger, 1901

'*Chrysophanus Hb. Thetis* Klug. v. *Caudatus* Stgr.' Staudinger, 1901: 73. Type locality: 'Arm.[enia] m.[eridionalis]; Pont.[us] or.[ientalis]; Kurd.[istan] s.[eptentrionalis] oc.[cidentalis]. — Junior subjective synonym of *Lycaena thetis thetis* Klug, 1834.

Lectotype ♂:

- ♂ with labels: handwritten (Staudinger) 'Thetis II Gen. | v. Caudata' (on white paper), handwritten 'Kasikoparan | Cauc. m. Chr.[istoph]' (on green paper), handwritten 'thetis caudatus Staudinger, 1901 | LECTOTYPUS | Nekrutenko design. 1983' (on yellow paper) — Nekrutenko *in* Hesselbarth *et al.* (1995: 491).

Paralectotypes 3♂, 4♀:

- 3♂, 4♀ with circles of green locality label paper — Nekrutenko *in* Hesselbarth *et al.* (1995: 491).

caudatus Staudinger, 1901

'*Chrysophanus* Hb. *Sarthus* Stgr. v. *Caudatus* Stgr.' Staudinger, 1901: 75. Type locality: 'Buch.[ara] s.[eptentrionale] or.[ientale] (Karategin).' — Junior primary homonym of *Chrysophanus thetis caudatus* Staudinger, 1901: 73 (above; precedence in pages); replacement name: *Lycaena ophion* Hemming, 1933: 278.

Syntypes 5♂:

- ♂ with labels: handwritten (Staudinger) 'v. Caudatus | Stgr.' (on white paper), handwritten 'Karategin | [18]89 Maur.[er]' (on brown paper) and printed 'Origin.' (on pink paper);
- 4♂ with circles of brown locality label paper and printed 'Origin.' (on pink paper); one specimen has also handwritten (Staudinger) 'Sarthus var. | Caudatus Stgr. (recto) | Caspius var. | Catapyrrus | Stgr. in l. (verso)' (on white paper); one specimen has also a handwritten label 'v. Catapyrrus' (on white paper, in pencil); printed Staudinger label 'Origin.' missing.

charybdis Staudinger, 1886

'*Lyc.*[*aena*] *Charybdis* Stgr.' Staudinger, 1886: 226. Type locality: '...erhielt ich aus der Umgegend von Margelan und Namangan...'

Syntypes 8♂, 5♀:

- ♂ with labels: handwritten (Staudinger) 'Charybdis | Stgr.' (on white paper), handwritten 'Margelan | Maur.[er] [18]84' (on brown paper), printed 'Origin.' (on pink paper);
- 5♂, 3♀ with circles of brown locality label paper and printed 'Origin.' (on pink paper); one male specimen has a handwritten (Staudinger) label 'Charybdis | Stgr.' (on white paper);
- ♂ with labels: handwritten 'Namangan | Hbh. [Haberhauer] [18]84' (on brown paper), printed 'Origin.' (on pink paper);
- ♂, 2♀ with circles of brown locality label paper and printed 'Origin.' (on pink paper).

christophi Staudinger, 1874

'*Lycaena Christophi* n. sp.' Staudinger, 1874: 87. Type locality: 'Herr Christoph... entdeckte diese Art zuerst bei Schahrud im nördlichen Persien.' ... 'Im voriger Jahr fand er die Art einzeln bei Krasnowodsk in Turkestan'; restricted by the lectotype designation: 'Schahrud [Iran, Semnān Province, Shāhrūd]' (Olivier, van der Poorten & De Prins, 1998: 91).

Lectotype ♂:

- ♂ (antennae missing), with labels: handwritten (Christoph) 'Schahrud | Chr[istoph]' (on yellow paper), printed 'Origin.' (on pink paper), printed '*christophi* Staudinger, | 1874 | LECTOTYPUS | Olivier, v.d. Poorten & De Prins design. | *Phegea* 1998 26(3): 91, pl. 1, f. 1, pl. 2, f. 1' — Olivier, van der Poorten & De Prins (1998: 91, pl. 1, 2, fig. 1); Tshikolovets (1997a: 136, 238, pl. 40, fig. 12(14).

Paralectotypes 6♂, 12♀:

- 5♂, 11♀ with circles of yellow locality label paper and printed labels 'Origin.', some have small handwritten date labels, ♂ and 4♀ have no 'Origin.' labels;

- ♂ (abdomen missing), ♀ with labels: handwritten (Püngeler) 'Regn.[i] Pers.[iae] | sept.[entrionalis]' (on white paper, in printed box) and handwritten (Püngeler) on printed form 'Cotype <underlined> | *Christophi Stgr.* ♂ (♀)| *vom Autor* | *Püngeler*' (on pink paper).

chrysopis Grum-Grshimaïlo, 1888

'*Lycaena Chrysopis* m.' Grum-Grshimaïlo, 1888: 306. Type locality: 'Hindukush orient.'

Paralectotypes ♂, ♀:

- ♂ with labels: handwritten (Staudinger) 'Chrysopis | Gr. Gr.' (on white paper), handwritten (Grum-Grshimaïlo, in Russian) 'Beik | 12. VII.[18]87' (on white paper), handwritten 'Hindukusch or.[ientalis] | [18]87 Gr. Gr.' (on brown paper);
- ♀ with circle of brown locality label paper and handwritten (Grum-Grshimaïlo, in Russian) label 'Beik | 11. VII.[18]87' (on white paper).

In evidence that these specimens, forwarded by Grum-Grshimaïlo to Staudinger, belong to the type series, a quotation from a subsequent publication by the author (redescription and type locality restriction) follows: 'J'ai découvert *Chrysopis* dans les monts Kounjout, où elle volait sur les bords d'un ruisseau, qui se déverse dans le Beïk méridional' (Groum-Grshimaïlo, 1890: 416–417, pl. 10, fig. 5a, 5b). Lectotype designated by D'Abrera (1993: 498, figs. [not numbered] 'det. Balint' — deposited in The Natural History Museum, London; see also Tshikolovets, 1997a: 158).

The specimens are provided now with a printed label '*chrysopis* | Grum-Grshimaïlo, 1888 | SYNTYPUS | Y. Nekrutenko det 5.12.1998' (on yellow paper).

cilissa Lederer, 1861

'*Cigaritis Cilissa*' Lederer, 1861: 147, Taf. 1, Fig. 1. Type locality: 'Bei Mersin und Antiochia'.

Syntypes ♂, 2♀:

- ♂ with labels: handwritten 'Antiochia' (on white paper), printed 'Coll. Led.' (on white paper) and 'Origin.' (on pink paper);
- 2♀ with labels: handwritten 'Antiochia', circles of white locality label paper and printed labels 'Coll. Led.' (on white paper) and 'Origin.' (on pink paper).

The specimens are placed under a handwritten (Staudinger) drawer label 'v. Transcaspica | Stgr.' (on white paper).

cinnides Staudinger, 1901

'*Lycaena* F. *Bellargus* Rott. ab. *Cinnides* Stgr.' Staudinger, 1901: 86. Type locality: not stated. — Infrasubspecific.

Types: not found (probably not designated).

clara Staudinger, 1901

'*Lycaena* F. *Baton* Berg. v. et ab. *Clara* (Stgr.) Chr. Mém. Rom. III p. 51' Staudinger, 1901: 81. Type locality: 'Syr.[ia]; Kurd.[istan]; Tura; Ferg.[ana] m.[eridionalis] etc.' — Junior primary homonym of *Lycaena clara* Edwards, 1880; replacement name: *Scolitantides astabene* Hemming, 1932: 181.

Types: not found.

cognata Staudinger, 1892

'*Thecla Orientalis* Murr. (*Diamantina* Obrth) und var. ? *Cognata* Stgr.' Staudinger, 1892b: 152 (footnote). Type locality: 'Dörries brachte 11 Pärchen aus dem Sutschan-Gebiet... Denn es liegen mir 3 fast ganz mit diesen übereinstimmende ♂♂ vom Uss.[uri], Suif.[un] und Ask.[old] vor und von Ask.[old] auch 4 völlig übereinstimmende ♀♀'.

Lectotype ♂:

- ♂ (abdomen removed), with labels: handwritten (Staudinger) 'v. Cognata ♀♀ | Stgr.'<sic> (on white paper), handwritten 'Sutschan | [18]90 Dörr.[ies]' (on violet-bluish paper), printed 'Origin.' (on pink paper), three slovenly scribbled handwritten (Dantchenko): '8.03.[19]96 | Dantchenko | abdomen' and '4' (both on white paper, in red ink), and 'S. Cognata <blot> | Stg. | lectotypus | Dantchenko | A. V. gesign. (sic!) | 1996' (on red paper, in black ink), printed 'Lectotype: - | Thecla orientalis |

var. cognata Staudinger | Designated by | S. Matsuda, 1996' (on white paper and glued to a larger piece of red coloured paper) — Matsuda (1996: 175, Fig. 1a – 1c).

Paralectotypes 4♂, 10♀:

- ♂ with labels: handwritten 'Askold | Dörr.[ies] [18]83' (on bluish-violet paper), printed 'Origin.' (on pink paper), and two handwritten (Dantchenko) 'Dantchenko | abdomen | 8.03.[19]96' and '5' (both on white paper, in red ink), printed 'Paralectotype: - | Thecla orientalis | var. cognata Staudinger | Designated by | S. Matsuda, 1996' (on white paper and glued to a larger piece of red coloured paper) — Matsuda (1996: 175, Fig. 3a – 3c).
- ♂ with labels 'Ussuri | Dörr.[ies] [18]82' (on bluish-violet paper), printed 'Origin.' (on pink paper), printed 'Paralectotype: - | Thecla orientalis | var. cognata Staudinger | Designated by | S. Matsuda, 1996' (on white paper and glued to a larger piece of yellow coloured paper) — Matsuda (1996: 175, Fig. 2a – 2c).
- 3♀ with circles of bluish-violet locality label paper and printed 'Origin.' (on pink paper), one of them with handwritten (Dantchenko) labels '8.03.96 | Dantchenko | abdomen' and '3' (both on white paper, in red ink), another with handwritten (Dantchenko) 'abdomen | Dantchenko | 8.03.96' and '6' (both on white paper, in red ink), all with printed labels 'Paralectotype: - | Thecla orientalis | var. cognata Staudinger | Designated by | S. Matsuda, 1996' (on white paper glued to a larger piece of yellow coloured paper) — Matsuda (1996: 175, Figs 4a–c, 5a–c, 7a–c);
- ♀ with labels: handwritten (Staudinger) 'Orientalis var. | Cognata Stgr. | ♀ dimorph' (on white paper), handwritten 'Sutschan | [18]90 Dörr.[ies]' (on bluish-violet paper), printed 'Origin.' (on pink paper), 'Paralectotype: - | Thecla orientalis | var. cognata Staudinger | Designated by | S. Matsuda, 1996' (printed on white paper glued to a larger piece of yellow coloured paper) — Matsuda (1996: 175, Fig. 6a – 6c);
- 2♀ not designated as paralectotypes though placed aside and having Staudinger's printed labels 'Origin.' and circles of

bluish-violet locality label paper, each with handwritten (Staudinger) labels 'v.? Cognata ♀♀ | von Askold <underlined>' and 'Brillantina | Orientalis hybr.?' (both on white paper).

An additional 2♂ and 4♀ housed in another cabinet were apparently not found by Matsuda and also constitute an integral part of the type series:

- ♂ with labels: handwritten (Staudinger) 'Thecla v. ? | Cognata Stgr. | type from Sutschan <sic! in English>' (on white paper), a circle of bluish-violet paper) and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten (Staudinger) 'Orientalis var. | Cognata Stgr.' (on white paper), handwritten 'Sutschan | [18]85 Dörr.[ies]' (on bluish-violet paper), printed 'Origin.' (on pink paper);
- ♀ with labels: handwritten (Staudinger) 'v.Cognata ♀♀ | Taxila <illegible> <crossed out> | von Askold | früher beschrieben' (on white paper), a circle of bluish-violet paper and printed 'Origin.' (on pink paper);
- ♀ with a circle of bluish-violet paper and printed 'Origin.' (on pink paper);
- ♀ with labels: handwritten (Staudinger) 'Cognata ¿ | dimorph?' (on white paper), a circle of bluish-violet paper and printed 'Origin.' (on pink paper);
- ♀ with labels: handwritten 'Askold | [18]83 Dörr.[ies]' (on bluish-violet paper) and printed 'Origin.' (on pink paper).

corydonius Herrich-Schäffer, [1852]

'[*Lycaena*] *Corydonius*' Herrich-Schäffer, [1852] **1**(54): Tab. 123, Figs 595, 596; *Lycaena corydon* Zeller [Lokalvarietät] *Corydonius* Kef. [1852] **6**(55): 27. Type locality: 'Aus der Türkei… Aus Südrussland.'

Neotype ♂:

- ♂ with labels: handwritten 'Helenendorf' (on white faded yellowish paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Schurian) on printed lined form

'*Polyommatus* | *(Lysandra)* | *corydon corydonius* | *H.-S. 1852* | *det. Schurian* 1988' (on white paper), handwritten (Schurian) on printed form 'Gen. Präparat | Nr. *221*/1986 | *Schurian*' (on white paper), handwritten (Schurian) on printed form 'Neotypus ♂ | *Lysandra corydonius* | *H.-S. (1852)* | *teste* SCHURIAN 1985' (on red paper), and '*Neotypus* ♂ <written over printed 'Paratypus'> | *[Lycaena]* | *corydon corydonius* | *H.-S. 1852* | des. Schurian, 1988' (on red paper, in box) — Schurian (1988: 137, Taf. 1, 2, Fig. 6).

crimaea A. Bang-Haas

Unpublished.

Syntype ♂:

- ♂ with labels: handwritten (Püngeler) 'Krim (recto) | als damone Ev. | v. crimaea B-H ♂ | 3/1913 v.[vom] Autor | Püng.[eler] (verso)', handwritten date label '27/VI | 1911' (on white paper), handwritten (Forster) on printed form '*Agrodiaetus* | *poseidon* ♂ | *krymaea Shelj.* | det. W. Forster 1943', printed, with handwritten (Püngeler) insertion 'Cotype <underlined> | v. crimaea B-Haas ♂' (on pink paper).

The specimen is placed under a handwritten (Püngeler) drawer label 'Poseidon HS. | v. Crimaea B-Haas' (on white paper, in printed box).

cyanea Staudinger, 1899

'*Lycaena Damone* var. *Cyanea*' Staudinger, 1899: 142. Type locality: 'zwei Pärchen durch Haberhauer von Achalzich erhielt und 3 ♂♂ in Lederers Sammlung aus Hankynda vorfand'; (restricted by the lectotype designation): Hankynda (Stepanakert = Xankändi, Nagorno-Karabakh — Forster (1956: 85).

Lectotype ♂:

- ♂ with labels: handwritten 'Hankynda' (on white paper), printed, with handwritten insertion 'Coll. Led. | *Kindermanni*' (on white paper), printed 'Origin.' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Forster) on printed form '*Lecto*-Typus ♂ | *Lycaena damone* | *cyanea Stgr.* | W. Forster München' (on pink paper), printed, with handwritten

(Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *123* Figur *36*' (on white paper) — Forster (1956: 85); Hesselbarth *et al.* (1995: Taf. 123, Fig. 36); Häuser & Eckweiler (1997: 70); Eckweiler & Häuser (1997: 122, Pl. 6).

Paralectotypes 4♂, ♀:

- ♂ with labels: handwritten 'Hankynda' (on white paper), printed, with handwritten insertion 'Coll. Led. | *Damocles*' (on white paper), printed 'Origin.' (on pink paper) and a circle of green paper (?-see locality label of *pseudocyanea* Forster below);
- ♂ with labels: printed, with handwritten insertion 'Coll. Led. | *Damocles*' (on white paper), and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Achalzich | Hbhr. [Haberhauer] [18]82' (on green paper) and printed 'Origin.' (on pink paper);
- ♀ with a circle of green paper, small date label '2/8' and printed label 'Origin.' (on pink paper);
- ♂ with labels: handwritten (Staudinger) 'Derbent | Beckr. [Becker]' (on green paper), handwritten (Staudinger) 'Kindermanni | ab.?' (on white paper), printed '300.' (on white paper faded brown), handwritten (Forster) on printed form '*Polyommatus* | *(Agrodiaetus)* | *carmon* ♂ | *cyanea Stgr.* | det. W. Forster 19*47*' (on white paper).

cyprius Stichel, 1911

'*Thestor romanovi cyprius* Stich., subsp. nov.' Stichel, 1911: 76. Type locality: 'Sehr local, auf Höhen von 3000–3500 m nächst Sultanabad.' — Junior subjective synonym of *Thestor romanovi* Christoph, 1881 (Hesselbarth *et al.*, 1995: 506).

Syntypes ♂, ♀:

- ♂ with labels: cuttings from the proof-sheet of the original description '*Thestor romanovi cyprius* Stich. | ...larum omnium latiore a subspe...' and 'Sultanabad' (on white paper, the text is on one side only, so that they are for sure cut out from a proof sheet), printed 'Nachträgl. der | Coll. Püngeler | hinzugefügt.' (on greyish paper) and printed 'Typus' (on red paper);

- ♀ with labels: printed 'Nachträgl. der | Coll. Püngeler | hinzugefügt.' (on greyish paper) and printed 'Typus' (on red paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Romanovi Chr.' (on white paper, in printed box).

cytis Christoph, 1877

'*Lycaena Cytis* Chr.' Christoph, 1877: 234, Tab. 5, Figs 5, 6. Type locality: 'Ich fing den, wie es scheint, sehr seltenen Schmetterling im Juli bei Schahkuh... von 8 bis 10,000' Höhe'.

Syntypes ♂, ♀:

- ♂, ♀ with labels: handwritten (Püngeler) 'Hyrcania' (on white paper, in printed box), and handwritten (Püngeler) on printed form 'Cotype <underlined> | *Cytis Chr.* ♂ (♀)| *von Stgr.* | *Püngeler*' (on pink paper); male specimen with small handwritten (Christoph) date label '11/7' (recto white, verso green), female specimen with small square piece of white paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Cytis Chr.' (on white paper, in printed box).

dagmara Grum-Grshimaïlo, 1888

'*Lycaena Dagmara* m.' Grum-Grshimaïlo, 1888: 306. Type locality: 'Darwaz'.

Syntypes ♂, ♀:

- ♂ with labels: handwritten (Staudinger) 'Dagmara | Gr. Gr. | Chingoe-darja | Darwas.' (on white paper), handwritten 'Darwas | [18]85 Gr.[um] Gr.[shimaïlo]' (on brown paper), handwritten (Grum-Grshimaïlo, in Russian) 'Tobi | dara.' (on white paper) and small handwritten (Grum-Grshimaïlo) date label '10.VI | [18]85.' (on white paper);
- ♀ with circle of brown locality label paper, handwritten (Grum-Grshimaïlo, in Russian) 'Tobi | dara.' (on white paper) and small handwritten (Grum-Grshimaïlo) date label '10.VI | [18]85.' (on white paper).

In evidence that these specimens, forwarded by Grum-Grshimaïlo to Staudinger, belong to the type series, a quotation from a subsequent publication by the author (redescription and type locality restriction) follows: 'Je n'ai trouvé *Dagmara* qu'une seule fois, près du col Agwaï-Polousak et en suite sur l'ancien "saï" du Khingoob-Darya, près de Tobi-Dara. De 7,000 à 5,500 p. (Commencement de Juin)' (Groum-Grshimaïlo, 1890: 412–414, pl. 9, fig. 2a, 2b; see also Häuser & Eckweiler, 1997: 70).

The specimens are provided now with a printed label '*dagmara* | Grum-Grshimaïlo, 1888 | SYNTYPUS | Y. Nekrutenko det. 16.11.1998' (on yellow paper).

dama Staudinger, 1892

'*Lycaena Dama* Stgr. n. sp.' Staudinger, 1892a: 234. Type locality: '...wurde von Manissadjian Ende Juli bei Malatia in einer grössere Anzahl von ♂♂ und weniger ♀♀ entdecket'.

Syntypes 6♂, 4♀:

- ♂ with labels: handwritten (Staudinger) 'Dama | Stgr.' (on white paper), handwritten 'Malatia | [18]84 Man.[issadjian]' (on yellow paper), printed 'Origin.' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), printed, with handwritten (Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *118* Figur *29*' (on white paper);
- 5♂, 4♀ with circles of yellow locality label paper, printed 'Origin.' (on pink paper), some with small date labels, and printed 'Zool. Mus. | Berlin' (on pale yellow paper); one of the male specimens also has new handwritten labels '20.' (on cross-lined notebook paper) and 'dama' (on white paper), one male specimen — handwritten label (Staudinger) 'Dama | Stgr.' (on white paper) and handwritten date label '25/7' (on white faded paper), one female specimen — a handwritten label '21.' (on cross-lined notebook paper), handwritten (Wagener) 'Lycaena dama | Stgr. 1892 ♀ | Malatia 84 Man.' (on white paper) and printed, with handwritten (Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *118* Figur *52* <recte: *49*>' (on white paper) —

Hesselbarth *et al.* (1995: 727, Taf. 118, Fig. 29, 49); cf. Häuser & Eckweiler (1997: 70–71), Eckweiler & Häuser (1997: 133, Pl. 3) and Olivier, De Prins, van der Poorten & Puplesiene (1999: 202–204).

damonides Staudinger, 1899

'[*Lycaena*] *Damone* Ev. var. *Damonides*' Staudinger, 1899: 138. Type locality: 'In den Gebirgen Nordpersiens, besonders bei Hadschyabad und Schahkuh, sowie im südostlichen Transcaucasien (bei Ordubad [Azerbaijan, Naxçivan], auch bei Kasikoporan...'

Lectotype ♂:

- ♂ (abdomen missing) with labels: handwritten (Staudinger) 'v. Damonides | Stg.' (on white paper), handwritten 'Ordubat | Chr.[istoph]' (on green paper), handwritten (unknown hand) 'L. Iphigenia ? | Ordubad 10.6.[18]81' (on faded paper, the text strongly faded, almost invisible), printed 'Origin.' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Forster) on printed form '*Agrodiaetus* | *poseidon* ♂ | *damonides Stgr.* det W. Forster 19*48*' (on white paper), handwritten (Forster) '<u>Cotypus</u> | Lycaena | damone | damonides Stgr.' (on pink paper), handwritten (Forster) '<u>Lectotypus</u> | Lycaena | damone | damonides Stgr. | W. Forster 1948' (on pink paper), printed, with handwritten (Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *121* Figur *67*' (on white paper) — Forster (1961: 13); Hesselbarth *et al.* (1995: Taf. 121, Fig. 67); Häuser & Eckweiler (1997: 72); Eckweiler & Häuser (1997: 138, Pl. 5); Olivier, Puplesiene, van der Poorten, De Prins & Wiemers (1999: 15, Fig. 2).

Paralectotypes:

- 3♂, ♀ all with circles of green locality label paper, one male has also handwritten (unknown hand) label 'Ordub.[ad] 22.6.[18]81' (on faded paper, the text strongly faded, almost invisible) and printed 'Origin.' (on pink paper), one male — handwritten (unknown hand) label 'Ordub.[ad] 25.6.[18]81' (on faded paper, the text strongly faded, almost invisible), printed

'Zool. Mus. | Berlin' (on pale yellow paper), and two new labels: handwritten (Wagener) 'Lycaena damone damo- | nides Stgr. 1899 | Ordubad' (on white paper) and printed, with handwritten (Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *121* Figur *61*' (on white paper) (figured in Hesselbarth *et al.*, 1995: Taf. 121, Fig. 61, not '♀' as stated in the legend); female specimen has handwritten (unknown hand) label 'Ordub.[ad] 22.6.[18]81' (on faded paper, the text strongly faded, almost illegible);

- ♀ with labels: handwritten (unknown hand) 'Ordub.[ad] 10.6.[18]81' (on faded paper, the text strongly faded, almost invisible), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Forster) on printed form '*Agrodiaetus* | *poseidon* ♀ | *damonides Stgr.* det W. Forster 19*48*' (on white paper), handwritten (Forster) '<u>Cotypus</u> | Lycaena ♀ | damone | damonides Stgr.' (on pink paper), printed, with handwritten (Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *121* Figur *66*' (on white paper) — Olivier, Puplesiene, van der Poorten, De Prins & Wiemers (1999: 16).

All above specimens are placed under a handwritten (Staudinger) drawer label 'v. Damonides | Stgr.' (on white paper).

darius Eckweiler & ten Hagen, 1998

'*Polyommatus (Agrodiaetus) darius* spec. nov.' Eckweiler & ten Hagen, 1998: 110, Abb. 2–6. Type locality (holotype): 'Iran, Tehran, Elburs, Demavend, Polur, 2400 m'.

Paratype ♂:

- ♂ with printed labels: 'Iran, Tehran | Elburs, Demavend | Polur 2400 m | 18.VII.1997 | leg. W. ten Hagen' (on white paper), '**Paratypus** | *Polyommatus (Agrodiaetus)* | ***darius*** spec. nov. | des. Eckweiler & ten Hagen 1998' (on bluish paper, in box).

decolor Staudinger, 1886

'*Lycaena Argiades* Pall. var. *Decolor* Stgr.' Staudinger, 1886: 203. Type locality: 'Aus dem Umgegend von Margelan…'

Syntypes 3♂, ♀:

- ♂ with labels: handwritten (Staudinger) 'var. Decolor | Stgr.' (on white paper), handwritten 'Margelan | Maur.[er] [18]83' (on brown paper) and printed 'Origin.' (on pink paper);
- 2♂, ♀ with circles of brown locality label paper and printed 'Origin.' (on pink paper).

decolorata Staudinger, 1886

'*Lycaena Argiades* Pall. ... aberr. (eventuell auch var.) *Decolorata*.' Staudinger, 1886: 204. Type locality: '...aus Wien, Ungarn und von Bulgarien.'

Syntypes 3♂, 3♀:

- ♂ with labels: handwritten (Staudinger) 'ab. Decolorata | Stgr' (on white paper), handwritten 'Wien' (on yellow paper) and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Eperies | Dahlstr.' (on white paper) and printed 'Origin.' (on pink paper);
- ♂, ♀ with circles of white locality label paper and printed 'Origin.' (on pink paper);
- ♀ with labels: handwritten 'Balkan | Kr.[üper]' (on yellow paper) and printed 'Origin.' (on pink paper);
- ♀ with circle of white locality label paper and printed 'Origin.' (on pink paper).

dentata Staudinger, 1892

'*Thestor Callimachus* var. *Dentata*' Staudinger, 1892a: 233. Type locality: 'bei Mardin.' — Junior subjective synonym of *Lycaena callimachus* Eversmann, 1848.

Syntypes 5♂, 5♀:

- ♂ with labels: handwritten (Staudinger) 'var. Dentata | Stgr.' (on white paper), handwritten 'Mardin | [18]91 Manis.[sadjian]' (on yellow paper) and printed 'Origin.' (on pink paper);
- 4♂, 5♀ with circles of yellow locality label paper and printed 'Origin.' (on pink paper); one male specimen also has a handwritten (Staudinger) label 'Callimachus | v. Dentata | Mardin.' (on white paper).

depuncta Hirschke, 1903

'*Lycaena Argiades* Pall. ab. (et var.) *depuncta*' Hirschke, 1903: 270. Type locality: '...in oberen Czernatal...' — Infrasubspecific.

Syntype ♂

- ♂ with labels: printed, with handwritten (Hirschke?) insertion 'Hirschke. Wien | *Czernathal* | *V. 1901* | *Type* (recto) | *Depuncta Hirschke* | ♂ | *von* | *H. Hirschke 3/04* (verso, Püngeler)' (on white paper, recto in printed box), handwritten 'alcetas' (on white paper, in pencil), handwritten (Püngeler) on printed form 'Cotype <underlined> | *ab. depuncta Hirschke* ♂ | *3.1904 vom Autor* | *Püngeler*' (on pink paper).

The specimen is placed under a handwritten (Püngeler) drawer label 'Argiades Pall. | ab. Depuncta Hirschke' (on white paper, in printed box).

diana Miller, 1913

'*Lycaena diana* nov. sp.' Miller, 1913: 220. Type locality: 'L. diana fing ich im Kagysmanschen Bezirk zum grössen Teil in der Umgegend des Bergsee's Tschanglé, nördlich vom Arax. ... Die Höhe, in der sie leben, beträgt wie gesagt, etwa 1800–2000 m; Fangdatum bei Tschanglé 15.–17.VI.[1911]' (*op. cit.*: 221, 222).

'Syntypes' ♂, ♀:

- ♂ with labels: printed 'Kagyzman | 2500m <sic> Juni | Russ.[isch] Armen.[ien]' with handwritten (Püngeler) insertion on verso '*als diana Miller* | ♂ *4/1912 von* | *B-Haas* | *Püng.*[eler]' (on white paper), handwritten (Püngeler) on printed form 'Cotype <underlined> | *diana Miller* ♂ | *von B-Haas* | *Püngeler*' (on pink paper);
- ♀ with labels: printed 'Kagyzman | 2500m <sic> Juni | Russ.[isch] Armen.[ien]' with handwritten (Püngeler) insertion on verso '*als diana Miller* ♀ | *4/1912 v.*[on] *B-Haas* | *Püng.*[eler]' (on white paper), handwritten (Püngeler) on printed form 'Cotype <underlined> | *diana Miller* ♂ (♀) | *von B-Haas* | *Püngeler*' (on pink paper).

The lectotype was selected and designated from the type series unequivocally designated by Miller ('Vorliegendes Material 7 ♂

3 ♀') deposited now in Zoological Museum, Moscow University (Nekrutenko *in* Hesselbarth *et al.*, 1995: 655; cf. Antonova, 1981: 211). Up to the present, only 7♂ and 2♀ have been found. The forementioned specimens which Püngeler obtained from Bang-Haas may hardly belong to Miller's type series, and this doubt is clearly expressed on the labels.

difficillima Forster, 1956

'*Agrodiaetus transcaspica difficillima* ssp. nov.' Forster, 1956: 76, Taf. 10, Figs 5, 10, Taf. 11, Figs 5, 10. Type locality: 'Nordpersien, Schahkuh' (holotypus).

Paratypes 3♂, 3♀:

- ♂ with labels: handwritten (Staudinger) 'Damone var ?' (on white paper), handwritten 'Hadsch. ? | Hbhr. [Haberhauer]' (on yellow paper), printed '290.' (on white paper faded brown), handwritten (Forster) on printed form 'Para-Typus ♂ | *Agr.*[*odiaetus*] *transcaspica* | *ssp. difficillima Forster* | W. Forster München' (on pink paper);
- ♂ with labels: printed '314.' (on white paper faded brown), printed 'Origin.' (on pink paper), handwritten (Forster) on printed form '*Co*-Typus ♂ | *Lycaena damone* | *iphidamon Staudinger*' (on pink paper), handwritten (Forster) on printed form 'Para-Typus ♂ | *Agr.*[*odiaetus*] *transcaspica* | *ssp. difficillima Forster* | W. Forster München' (on pink paper);
- ♀ with labels: handwritten 'Schakuh | Chr.[istoph]' (on yellow paper), printed '289.' (on white paper faded brown), small date label '22/7' (recto white, verso green), a small piece of white paper, handwritten (Forster) on printed form '*Co*-Typus ♀ | *Lycaena damone* | *ssp. damonides Stgr.*' (on pink paper), handwritten (Forster) on printed form 'Para-Typus ♀ | *Agrodiaetus trans-* | *caspica difficillima* | *Forster* | W. Forster München' (on pink paper);
- ♂, 2♀ with labels: printed, with handwritten insertions 'HYRCANIA, (Schahkuh) | <male with handwritten date *25.7*>' (on white paper, in box) and handwritten (Forster) on printed form 'Para-Typus ♂ (♀) | *Agr.*[*odiaetus*] *transcaspica* | *ssp. difficillima Forster* | W. Forster München' (on pink paper); female

specimens also have handwritten labels 'transcaspica' (on white cross-lined notebook paper).

dilutior Staudinger, 1881

'*Polyomm.*[*atus*] *Dimorphus* Stgr. n. sp. ... var *dilutior*' Staudinger, 1881: 283. Type locality: '...bei Margelan (und, wie ich glaube, auch im Tianschen) kommt sie mit Phoenicurus zusammen (ob an anderen Lokalitäten fliegend?) vor'.

Lectotype ♂:

- ♂ (abdomen missing), with labels: handwritten 'Margelan | Hbhr. [Haberhauer]' (on brown paper), printed 'Origin.' (on pink paper), printed 'ex collect. | Staudinger' (on photographic paper) and printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Nekrutenko) on printed form in box 'Figurat | par Y. Nekrutenko in: | *Vestn. zool. 1984, 6:* | *tab. ex adv. p. 48*' (on white paper), handwritten (Nekrutenko) 'dilutior Stgr. | Lectotypus | Y. Nekrutenko design. | 10.IX.1983' (on yellow paper) — Nekrutenko (1984: 45, pl. [1]).

Paralectotypes 5♂:

- 5♂ with circles of brown locality label paper and printed 'Origin.' (on pink paper).

dimorphus Staudinger, 1881

'*Polyomm.*[*atus*] *dimorphus*' Staudinger, 1881: 282. Type locality: 'Von dieser merkwürdigen Art sandte Haberhauer 6 Stück (1 ♂, 5 ♀) meist geflogen von Lepsa ein'.

Lectotype ♂:

- ♂ with labels: handwritten 'Lepsa | Hbhr. [Haberhauer]' (on brown paper), printed 'Origin.' (on pink paper, in box), printed 'ex collect. | Staudinger' (on photographic paper), printed 'Zool. Mus. | Berlin' (on yellow paper), handwritten (Nekrutenko) on printed form in box 'Figurat | par Y. Nekrutenko in: | *Vestn. zool. 1984, 6:* | *tab. ex adv. p. 49*' (on white paper), handwritten (Nekrutenko) 'dimorphus Stgr. | Lectotypus | Y. Nekrutenko design. | 10.IX.1983' (on yellow paper) — Nekrutenko (1984: 46, pl. [2]).

Paralectotypes 5♀:

- 5♀ with handwritten (Nekrutenko) labels 'dimorphus Stgr. | Paralectotypus | Y. Nekrutenko design. | 10.IX.1983' (on blue paper) — Nekrutenko (1984: 44).

dobrogensis Caradja, 1895

'*Thestor Nogelii* HS. var. *Dobrogensis* Caradja' Caradja, 1895: 34. Type locality: Romania, Dobrogea, '...Ende Juni [1865] 2 Stunden von Tultscha auf Bergen an Astragalus ponticus gefligen (Mn. [Mann]).'— Junior subjective synonym of *Thecla Nogelii* Herrich-Schäffer, [1851] (Hesselbarth *et al.*, 1995: 510).

Syntypes 3♂, 2♀:

- ♂ with handwritten label 'Tultscha | Mn. [Mann]' (on yellow paper);
- ♀ with a circle of yellow locality label paper;
- 2♂ with labels: handwritten 'Tultscha' and printed 'Coll. Led.' (both on white paper);
- ♀ with printed label 'Coll. Led.' (on white paper).

As supportive evidence that these specimens belong to the type series, a quotation from the original description follows (Caradja, 1895: 1: 'Der rühmlichst bekannte Entomologe [Mn. = Joseph Mann – op. cit.: 6] giebt uns neben eingehender Schilderung der vor ihm besuchtet Gegend eich reichhaltiges Verzeichniss der währen der Monate Mai, Juni und Juli [1865] bei Tultscha... Ein Theil dieser Thiere befindet sich im K. K. Hofmuseum zu Wien, ein anderer Theil derselben kam mit Lederer'schen Sammlung in der Besitz des Herrn Dr. Otto Staudinger').

The specimens are placed under a handwritten (Staudinger) drawer label 'v. Dobrogensis | Caradja | alle typen <sic>' (on white lined notebook paper); each provided now with a printed label: '*dobrogensis* | Caradja, 1895 | SYNTYPUS | Y. Nekrutenko det. 13.11.1998' (on yellow paper).

dombaiensis Alberti, 1969

'*Lycaena anteros dombaiensis* nov. ssp.' Alberti, 1969: 197, Taf. 2, Fig. 1c. Type locality: '...am Tschutschchur-Paß (vereinfacht geschrieben Tschutschur-Paß) bei Dombai in Höhen von 2200–2900 m im Juli und August...'

Paratypes 4♂:

- 4♂ with labels: printed, with handwritten (Alberti) insertions 'N. W. Kaukasus | Dombai *2300* (*2800*) *m* | Tschutschur | *18.* (*20., 19/21*) *7.1965* | leg. Alberti' (on white paper, in blue ball pencil, in box), handwritten (Alberti) on printed form 'ssp. ♂ | dombaiensis | det.<crossed out> B. Alberti (recto) | Paratypus (verso)' (on white paper, recto in box, handwritten text in blue ball pencil), printed 'Paratypus' (on red paper, in box).

dschagataicus O. Bang-Haas, 1915

'*Lycaena pheretiades dschagataicus* n. var. B.-H.' Bang-Haas, O., 1915: 101. Type locality: '... am Nordabhange des Karakorum, in den gebirgen südlich der Stadt Chotan (Chinesische Tatarei)...' (p. 93).

Types: not found.

duplicata A. Bang-Haas, 1910

'*Lycaena damone* v. *duplicata* n. v.' Bang-Haas, A., 1910: 30. Type locality: 'Aus dem Juldus-Gebiete 3 ♂♂'.

Syntypes 3♂:

- ♂ with labels: handwritten (O. Bang-Haas) 'L.[ycaena] Damone | v. Duplicata | BH.' (on white paper), handwritten (O. Bang-Haas) 'Lyc.[aena] Überg.[ang] zu | Damone | v. Melania Stg | nach Pgl. [Püngeler] 1/1 [19]09' (on white paper) printed 'Juldus' (on white paper) and handwritten 'Orig.' (on pink paper);
- 2♂ with labels: printed 'Juldus' (on white paper) and printed 'Origin.' (on pink paper) — cf. Häuser & Eckweiler (1997: 74).

egea Herrich-Schäffer, [1852]

'[*Lycaena*] *Egea* Friv.' Herrich-Schäffer, [1852] **6**(55): 25–26; '*Lycaena Bavius*' [1847] **1**(26): Tab. 74, Figs 357–360. Type locality: 'Aus der Türkei'.

Types: not found.

epidolus Herrich-Schäffer, [1843]

'*Lycaena Epidolus*' Herrich-Schäffer, [1843] **1**(1): Tab. 4, Figs 18, 19; '[*Lycaena*] *Epidolus* Boisd.' [1844] **1**(7): 114. Type locality: 'Bei Constantinopel. Von Herrn Frivaldszky und Herrn Keferstein erhalten.'— Junior primary homonym of *Lycaena epidolus* Boisduval, 1840; junior subjective synonym of *Lycaena menalcas* Freyer, 1837.

Types: not found (cf. Häuser & Eckweiler, 1997: 75).

erotides Staudinger, 1892

'*Lyc.*[*aena*] *Eros* O. var. *Erotides* Stgr.' Staudinger, 1892d: 319. Type locality: 'Die 13 vorliegenden ♂♂ vom Kentei...'

Syntypes 5♂:

- ♂ with labels: handwritten (Staudinger) 'v. Erotides | Stgr.' (on white paper), and 'Kentei | [18]89 Dörr.[ies]' (on green paper), printed 'Origin.' (on pink paper);
- 3♂ with circles of green locality label paper and printed label 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Mongol. | (Changai) (recto) | erotides ♂ | v.[om] Stgr. 4.1900 (verso)' (on white paper, recto in printed box) and handwritten (Püngeler) on printed form 'Cotype <underlined> | *v. erotides Stgr.* ♂ | *vom Autor* | *Püngeler*' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Eros O. | v. Erotides Stgr.' (on white paper, in printed box).

erschoffii Lederer, 1869

'*Lycaena Erschoffii* Led.' Lederer, 1869: 80, Taf. 4, Figs 4, 5. Type locality: '...bei Astrabad in Persien...' (op. cit.: 73).

Syntypes 2♂, ♀:

- 2♂, ♀ with labels: handwritten 'Hadschyabad' (on white paper), printed 'Coll. Led.' (on white paper), printed 'Origin.' (on pink paper) and handwritten (Häuser) on printed form '<u>SYNTYPUS</u> | *Lycaena* | *erschoffii* | *LEDERER* | det. Chr. L. Häuser | *VI.*[19]*94*' (on pink paper) — Häuser & Eckweiler (1997: 75).

erythrea Staudinger, 1892

'*Cigaritis Siphax* Luc. ab. (var.) *Erythrea* Stgr.' Staudinger, 1892c: 280. Type locality: 'von Collo (Provinz Constantine)'.

Syntypes 4♂, ♀:

- ♂ with labels: handwritten (Staudinger) 'ab. (var.?) Erythrea | Stgr.' (on white paper), handwritten 'Collo | Seriz' (on white paper) and printed 'Origin.' (on pink paper);
- 2♂, ♀ with circles of yellow locality label paper and printed label 'Origin.' (on pink paper),
- ♂ with labels: handwritten 'Bône | [18]91 Vall.[?]' and printed 'Origin.' (on pink paper).

erzurumensis Eckweiler & Hesselbarth, 1978

'*Agriades pyrenaicus erzurumensis* n. subsp.' Eckweiler & Hesselbarth, 1978: 65, Abb. 1–4. Type locality (holotype): 'Türkei, Prov. Erzurum: Palandöken Dağ, 2900–3100 m.' — Junior subjective synonym of *Lycaena dardanus* Freyer, [1843] (Hesselbarth *et al.*, 1995: 622).

Paratypes 3♂:

- 3♂ with printed labels: 'Türkei/Erzurum | Palandöken Dag | 29oo-31oo <sic> m | 27.7-31.7.[19]77 | leg. Eckweiler' (on white paper) and 'Paratypus ♂ | Agriades pyrenaicus | ssp. erzurumensis | des. ECKWEILER et | HESSELBARTH 1978' (on red paper).

estonica Hoyningen-Huene, 1883

'*Polyommatus* [*virgaureae*] var. *Estonica*' Hoyningen-Huene, 1883: 49. Type locality: 'Die var. Estonica fliegt in Esthland, unter 59½° nördl. Breite...'

Syntypes 4♂, 4♀:

- ♂ with labels: handwritten (Staudinger) 'Var. Estonica | Huene' (on white paper), printed 'Estonia. | HUENE' (on dirty-violet paper, in box) and circle of green paper;
- 3♂, 4♀ with same printed labels and circles of green paper.

Part of the type material was sent by the author through to Staudinger (and to S. Alphéraky) to get an advice before publishing a description (Hoyningen-Huene, 1883: 50).

The specimens are provided now with a printed label '*virgaureae estonica* Huene, 1883 | SYNTYPUS | Y. Nekrutenko det. 26.10.1998' (on yellow paper).

euphemia Staudinger, 1887

'*Lycaena Euphemia* Stgr. (*Euphemus* Hb. var.?)' Staudinger, 1887b: 142, 288, pl. 13, fig. 6. Type locality: '... von Raddefka (nur 2 ♂♂), Ussuri, Askold (nur 1 ♀) und von Sidemi in Korea und nördlich von Peking.'

Syntypes 5♂, 3♀:

- ♂ with labels: handwritten (Staudinger) 'Euphemus var. | Euphemia Stgr.' (on white paper), handwritten 'Raddefskaja | Chr.[istoph].' (on violet-blue paper), small date label '19/7' and printed 'Origin' (on pink paper);
- ♂, ♀ with circles of violet-blue locality label paper and printed 'Origin' (on pink paper);
- ♀ with labels: handwritten 'Askold | Dörr.[ies] [18]83' (on violet-blue paper) and printed 'Origin' (on pink paper);
- ♂ with labels: handwritten 'Sidemi | Jank.[owsky?]' (on violet-blue paper) and printed 'Origin' (on pink paper);
- ♂, ♀ with circles of violet-blue locality label paper and printed 'Origin' (on pink paper);
- ♂ with labels: handwritten 'Ussuri | Dörr.[ies] [18]82' (on violet-blue paper) and printed 'Origin' (on pink paper);

eversmanni Staudinger, 1886

'*Lycaena Eversmanni* Stgr. n. sp.' Staudinger, 1886: 205. Type locality: '...in den Gebirgen in einer Höhe von 1500—2000 Meter bei Margelan, Osch, Namangan und Samarkand im Juni und Juli vorzukommen' (see also Forster, 1941: 70–73, Taf. 2, Figs 1, 2, Taf. 3, Figs 1, 2). — Junior primary homonym and junior objective synonym of *Lycaena eversmanni* Lang, 1884: 370; senior objective synonym of *Plebejus ardis* Bálint & Johnson, 1997: 14, **syn. n.**

Syntypes 12♂, 11♀:

- ♂ with labels: handwritten (Staudinger) 'Eversmanni | Stgr.' (on white paper), 'Margelan | Hbhr. [Haberhauer]' (on brown paper), and printed 'Origin.' (on pink paper);

♂ with labels: handwritten 'Namangan | Hbh. [Haberhauer] [18]84' (on brown paper) and printed 'Origin.' (on pink paper);
♂ with labels: handwritten 'Prov. Samarkand | Hbhr. [Haberhauer] [18]81' (on brown paper) and printed 'Origin.' (on pink paper);
♂ with labels: handwritten 'Alai | [18]85 H.[aberhauer]' (on brown paper) and printed 'Origin.' (on pink paper);
♂ with labels: handwritten 'Osch | Hbh. [Haberhauer] [18]82' (on brown paper) and printed 'Origin.' (on pink paper);
7♂, 11♀ with printed labels 'Origin.' (on pink paper) and circles of brown locality label paper, 2♂, ♀ also have handwritten labels '2000 [metres] | 4/6 [18]80' (on blue paper).

fergana Staudinger, 1881

'*Lyc.*[*aena*] *Loewii* Z. var.? *Fergana* Stgr.' Staudinger, 1881: 262. Type locality: 'Die Stücke bei Margelan wurden von Ende Mai bis Juni gefangen.'

Syntypes 4♂, 5♀:

- ♂ with labels: handwritten 'Margelan | Hbhr. [Haberhauer]' (on brown paper) and printed 'Origin.' (on pink paper);
- 3♂, 4♀ with circles of the brown locality label paper and printed 'Origin.' (on pink paper);
- ♀ with labels: handwritten 'Saisan | Hbhr. [Haberhauer]' (on brown paper) and printed 'Origin.' (on pink paper);

Two of the male syntypes also have handwritten labels '08 9/61' and '30/5' (on blue paper).

fervida Staudinger, 1901

'*Callophrys Rubi* L. v. (gen. aest ?) *Fervida* Stgr.' Staudinger, 1901: 70. Type locality: 'Ib.[eria] m.[eridionalis], Maur.[itania], As.[ia] min.[or].'— Junior subjective synonym of *Papilio rubi* Linnaeus, 1758.

Syntypes:

- The types were not designated by Staudinger; under a handwritten (Staudinger) drawer label 'v. Fervida | Stgr.', 22 male and female specimens are placed from different localities: from S. Spain to Central Asia.

firdussii Forster, 1956

'*Agrodiaetus damone firdussii* ssp. nov.' Forster, 1956: 58, Taf. 8, Figs 16, 17, Taf. 9, Figs 16, 17. Type locality (holotypus): 'Nordiran, Schahkuh, Westabhang, Geröllzone, 1800–2000 m'.

Paratypes ♂, 2♀:

- ♂, 2♀ with labels: printed, with handwritten insertions 'HYRCANIA, (Schahkuh) [18]*98* <in male>, *21.7.*[1898], *14.7.[*18]*98* <in females>' (on white paper, in box) [leg. Funke – teste Forster, *l. cit.*: 58] and handwritten (Forster) on printed form 'Para-Typus ♂ (♀) | *Agrodiaetus damone* | *firdussii Forster* | W. Forster München' (on pink paper) — cf. Häuser & Eckweiler (1997: 77).

fortunata Staudinger, 1870

'*Lycaena Fortunata* nov. sp.' Staudinger, 1870a: 99. Type locality: 'Diese Art wurde von... Dr. Bauer... auf Teneriffa entdeckt. Dr. Bauer sammelte im Winter und Frühling 1864 auf Madeira und den Canarischen Inseln...' — Junior subjective synonym of *Polyommatus webbianus* Brullé, [1838] (Staudinger, 1901: 77).

Syntypes 2♂, ♀:

- ♂ with labels: handwritten (Staudinger) 'Teneriffa | Bauer' (on pale yellow paper) and printed 'Origin.' (on pink paper);
- ♂ with same handwritten (Staudinger) label;
- ♀ with circle of the pale yellow locality label paper and printed 'Origin.' (on pink paper).

The specimens are placed under a handwritten drawer label 'Webbianus | Brullé | Fortunata | Stgr.'; each provided now with a printed label '*fortunata* Staudinger, | 1870 | *webbianus* Brullé, [1838] | SYNTYPUS | Y. Nekrutenko det. 1.11.1998' (on yellow paper).

frivaldszkyi Lederer, 1855

'*Thecla Frivaldszkyi* Kindermann' Lederer, 1855a: 100, Taf. 1, Fig. 1. Type locality: 'Den Schmetterling fand Herr Kindermann auf Bergen in der Nähe von Ust-Buchtarminsk am 2. Juni kurz nach dem Schmelzen des Schnees; er erbeutete 15, meist geflogene Stücke und theilte mir ein Pärchen mit.'

Syntypes ♂, ♀:

- ♂ with labels: handwritten (Lederer?) 'Frivaldsz- | kyi Kind.[ermann] Led.[erer] | Sibiria occ. (recto) | Frivaldsz- | kyi (verso)' (on white paper, recto in printed box), printed 'Origin.' (on pink paper), 'Coll. Led.' (on white paper);
- ♀ with labels: handwritten (Kindermann) 'Altai' (on white paper), printed 'Origin.' (on pink paper), 'Coll. Led.' (on white paper).

galba Lederer, 1855

'*Lycaena Galba* Kollar' Lederer, 1855b: 190, Taf. 1 (not 2 as stated in the text), Fig. 4. Type locality: 'Ich erhielt nur 8 Stücke [Beirut]' — *l. c.*: 187.

Lectotype ♂:

- ♂ with labels: printed, in box 'Origin.' (on dirty-pink paper), printed 'Coll. Led.' (on white paper), handwritten (Lederer?) 'Beirut' (on white paper), printed 'Zool. Mus. | Berlin' (on pale-yellow paper), handwritten (Nekrutenko) label 'galba Lederer, 1855 | Lectotypus ♂ | Y. Nekrutenko design. | 7.XI.1983' (on yellow paper) — Nekrutenko (1984: 31, fig. 2, *1*).

Paralectotypes 3♀:

- ♀ with same labels as lectotype and handwritten (Nekrutenko) 'galba Lederer, 1855 | Paralectotypus ♀ | Y. Nekrutenko design. | 1984' (on blue paper);
- 2♀ with same printed labels as lectotype, one with a handwritten label 'Beirut' (on white paper).

gamra Lederer, 1855

'*Lycaena Gamra* Kollar in lit.' Lederer, 1855b: 189, Taf. 1, Fig. 3. Type locality: '[Beirut]' — *l. c.*: 187. — Junior subjective synonym of *Lycaena jesous* Guérin, 1847 (Staudinger, 1901: 77).

Syntypes

- ? — ♀ with printed labels 'Coll. Led.' (on white paper) and 'Origin.' (on pink paper);
- ? — 2♂ with printed labels 'Coll. Led.' (on white paper);

- 2♂, 3♀ labelled 'Beirut | Zach'

Lederer (1855b: 189–190) does not mention the number of specimens he saw, but apparently he had material of both sexes that were collected 'im Juni und Juli auf Brombeerblüthen'. They were certainly taken by Franz Zach in 1854, who stayed in Beirut and collected in its neighbourhood from 22 July 1853 until early August 1854. Therefore the specimens collected by Zach are certainly syntypes.

gerhardi Staudinger, 1895

'*Thecla Acaciae* Fab. var. *Gerhardi* Stgr.' Staudinger, [1895]: 241. Type locality: '...bei Mardin und Aintab (nördliches Mesopotamien, ersteres auch zum südlichen Kurdistan gerechnet)...' — Junior subjective synonym of *Thecla abdominalis* Gerhard, [1850] (Hesselbarth *et al.*, 1995: 531).

Syntypes 5♂, 4♀:

- ♂ with labels: handwritten (Staudinger) 'var. Gerhardi | Stgr.' (on white yellowish lined notebook paper), handwritten 'Mardin | [18]92 Man[issadjian]' (on yellow paper) and printed 'Origin.' (on pink paper);
- 3♂, 2♀ with circles of yellow locality label paper and printed 'Origin.' (on pink paper), one male specimen also has a handwritten date label '24/5', one also a handwritten (Staudinger) label 'var. Gerhardi | Stgr.' (on white-yellowish lined notebook paper, with an insertion in pencil 'Mardin');
- ♀ with labels: handwritten (Staudinger) 'var. Gerhardi | Stgr.' (on white yellowish lined notebook paper), handwritten 'Mardin | [18]88 Sont.[?]' (on yellow paper) and printed 'Origin.' (on pink paper);
- ♀ with circle of yellow locality label paper and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Aintab | [18]87 Man[issadjian]' (on yellow paper), handwritten date label '21/5' (on white paper) and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten (Püngeler) 'Mesopot.[amia] (recto) | acaciae var. | Gerhardi ♂ | von | A. Bang-Haas 1/[19]02 (verso)' (on white paper, recto in box), handwritten (Püngeler)

on printed form 'Cotype <underlined> | *v. Gerhardi Stgr.* ♂ | *von Bang-Haas* | Püngeler' (on pink paper);

- ♀ with labels: handwritten (Püngeler) 'Mesopot.[amia] (recto) | v. Gerhardi ♀ | ex coll Deckert | 5/1902 v.[om] M. Bartel (verso)' (on white paper), handwritten (Püngeler) on printed form 'Cotype <underlined> | *v. Gerhardi Stgr.* ♀ | *von M. Bartel* | Püngeler' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Acaciae F. | v. Gerhardi Stgr.' (on white paper, in printed box).

gigas Staudinger, 1871

'*Lycaena Loewii* Z. v. *Gigas*' Staudinger, 1871a: 10. Type locality: 'Lyd.[iae] alp.[es]' (restricted: 'Im Taurus fing Lederer eine riesige Form dieser Art... und die ich in meinem Catalog als *v. Gigas* bezeichnete.' — Staudinger, 1878: 234–235). — Junior subjective synonym of *Lycaena loewii loewii* Zeller, 1847 (Hesselbarth *et al.*, 1995: 613).

Syntypes 3♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'Taurus | Ld. [Lederer]' (on yellow paper) and printed 'Origin.' (on pink paper);
- ♀ with circle of yellow locality label paper and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Külek' (on white paper) and printed: 'Coll. Led.' (on white paper) and 'Origin.' (on pink paper);
- ♂, ♀ with labels: handwritten 'Syrien' (on white paper) and printed: 'Coll. Led.' (on white paper) and 'Origin.' (on pink paper).

gisela Püngeler, 1901

'*Lycaena gisela* n. sp.' Püngeler, 1901: 180, Taf. 2, Fig. 12, 12a, 12b. Type locality: not stated: 'Ausgangpunkt war die unter 41° 7' nördl. Breite und 80° 81' östl. L. v. Gr. gelegene Stadt Aksu...'

Syntypes 4♂, 4♀:

- ♂ with labels: printed, with handwritten (Püngeler) insertion 'Ost-Turkestan | (Aksu) | *Rückbeil 1900*' (on white paper) and

handwritten (Püngeler) on printed form 'Type <double underlined> | *gisela Püng.* ♂ | *abgebildet Iris 1901* | *Püngeler*' (on pink paper);

- 3♂, 4♀ with labels: printed, with handwritten (Püngeler) insertion 'Ost-Turkestan | (Aksu) | *Rückbeil 1900*' (on white paper) and handwritten (Püngeler) on printed form 'Cotype <underlined> | *gisela Püng.* ♂ (♀)| *Püngeler*' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Gisela Püng.' (on white paper, in box); the holotype designation (as 'Type') has not been published.

glaucias Lederer, 1870

'*Lycaena Glaucias* Led.' Lederer, 1870b: 10, Taf. 1, Figs 6, 7). Type locality: '...bei Astrabad in Persien... ...in 8000 Fuss Höhe das kleine, nur im Sommer von Hirten bewohnte Dorf Hadschyabad' (*op. cit.*: 4); 'Nur 7 Stücke erhalten.'

Syntypes 3♂, ♀:

- ♂ with labels: handwritten (Lederer) 'Glaucias | m.[ihi]' (on white paper, in printed box), and 'Hadschyabad' (on white paper), printed 'Coll. Led.' (on white paper) and 'Origin.' (on pink paper);
- 2♂, ♀ with labels: handwritten 'Hadschyabad' (on white paper), one male with printed 'Coll. Led.' (on white paper), all with printed labels 'Origin.' (on pink paper) — cf. Häuser & Eckweiler (1997: 79).

grumi Staudinger, 1901

'*Lycaena* F. *Eversmanni* Stgr. v. ? *Grumi* Stgr.' Staudinger, 1901: 79. Type locality: 'Transalai (sec.[undum] Maurer)' (see also Forster, 1941: 72–73, Taf. 2, Figs 6–8, Taf. 3, Figs 6–8).

Syntypes 4♂, 3♀

- ♂ with labels: handwritten (Staudinger) 'v.? Grumi | Stgr.' (on white paper), 'Transalai | Pamir? | [18]88 Maur.[er]' (on brown paper), and printed 'Origin' (on pink paper);
- 3♂, 3♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper).

haberhaueri Staudinger, 1886

'*Lyc.*[*aena*] *Sieversii* Chr. var. *Haberhaueri* Stgr.' Staudinger, 1886: 206. Type locality: '...Ende Mai bei Namangan wie Samarkand in Anzahl gefangen.'

Syntypes 9♂, 8♀:

- ♂ with labels: handwritten (Staudinger) 'Sieversi var.? | Haberhaueri | Stgr.' (on white paper), 'Namangan | Hbhr. [Haberhauer] [18]84' (on brown paper) and printed 'Origin.' (on pink paper);
- 6♂, 6♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper); one of the male specimens also has a small handwritten date label '24/5' (on white paper); one of the male specimens also has a handwritten (Staudinger) label 'Sieversi var.? | Haberhaueri | Stgr.' with insertion in pencil 'Namangan' (on white paper);
- ♂ with labels: 'Prov. Samark.[and] | Hbhr. [Haberhauer] [18]81' (on brown paper) and printed 'Origin.' (on pink paper);
- ♂, 2♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper).

helena Staudinger, 1862

'*Lycaena Helena*' Staudinger, 1862: 265. Type locality: '...liegt mir in fünf, theilweise gut erhaltenen Paaren vom Taygetos-Gebirge, aus dem südlichen Theil des Peloponnes vor, wo sie Anfangs Juni in einer Höhe von etwa 6–7000' durch Dr. Krüper erbeutet wurde'.

Syntypes ♂, 2♀:

- ♂ with labels: handwritten 'Taygetos | Kr.[üper]' (on yellow paper) and printed 'Origin.' (on pink paper);
- 2♀ with circles of yellow locality label paper and printed label 'Origin.' (on pink paper); one has a small date label '1/6'.

The specimens are placed under a handwritten drawer label 'Helena | Stgr.' (on white paper, in box).

helius Herrich-Schäffer, [1852]

'[*Polyommatus*] *Helius* Kad.' Herrich-Schäffer, [1852] **6**(55): 32. Type locality: 'Aus Kleinasien.' — Junior objective synonym of *Polyommatus asabinus* Herrich-Schäffer, [1851] (see above).

Types: not found.

heringi Kardakoff, 1928

'*Cyaniris argiolus* L. *heringi* (gen. aest. nov.)' Kardakoff, 1928: 272, Taf. 7, Figs 20, 21. Type locality: '...ich sammelte ihn hauptsächlich in der Umgegend von Wladiwostok im 2/2 V. [second half of May].' — Infrasubspecific.

Syntypes 2♂, 2♀:

- ♂, ♀ with labels: printed, with handwritten insertion 'Wladiwostok | S. Ussurigebiet | *7*.V. (*15*.V. in female)192*1* (N. Kardakoff' (on white paper), handwritten (Kardakoff?) 'Cyaniris argiolus L. | v. heringi Kardakoff' (on white paper) and printed 'Typus' (on red paper, in box) — these male and female specimens are figured in Kardakoff (1928: Taf. 7, Fig. 20 and 21 respectively);
- ♂, ♀ with labels: printed, with handwritten insertion 'Wladiwostok | S. Ussurigebiet | *10*.V. (*21*.V. in female)192*1* (N. Kardakoff' (on white paper), handwritten (Kardakoff?) 'Cyaniris argiolus L. | g. v. heringi Kard. | ded.<?> N. Kardakoff' (on white paper), printed 'Nachträgl. der | Coll. Püngeler | hinzugefügt' (on greyish paper) and printed 'Cotypus' (on red paper, in box).

***hispana* Herrich-Schäffer, [1851]**

'[*Lycaena*] *Corydon var. Hispana*' Herrich-Schäffer, [1851] **1**(49): Tab. 104, Figs 500–501; [1852] **6**(55): 27. Type locality: 'Exemplare aus Spanien sind auffallend klein und lebhaft gefarbt.'

'Lectotype' ♂:

- ♂ with labels: handwritten 'hispana' (on white paper, in ball pencil), printed 'Coll. Led.' (on white paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Schurian) on printed lined form '*Polyommatus* | *(Lysandra)* | *hispanus H.-S. 1852* | *det. Schurian* 1988' (on white paper), handwritten

(Schurian) on printed form 'Gen. Präparat | Nr. *206*/1*984* | Schurian' (on white paper), handwritten (Schurian) on printed form 'Lectotypus ♂ | *Lycaena hispana* | *H.-S.* | *(1852)* | teste. SCHURIAN, 1*984*' and '*Lectotypus* ♂ <written over printed 'Paratypus'> | *[Lycaena]* | *corydon hispana* | *H.-S. 1852* | design. Schurian, 1*988*' (on red paper, in box) — Schurian (1988: 132).

'Paralectotypes' 3♂:

- ♂ with labels: handwritten 'hispana' (on white paper, in ball pencil), handwritten (Staudinger) 'Barcelona' (on bluish-green paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Schurian) on printed lined form '*Paralectotypus* ♂ | *[Lycaena]* | *corydon hispana* | *H.-S. 1852* | *det. Schurian* 1*988*' (on white paper), handwritten (Schurian) on printed form 'Gen. Präparat | Nr. *207*/1*984* | Schurian' (on white paper), handwritten (Schurian) on printed form '*Para-* | Lectotypus ♂ | *Lysandra hispana H.-S.* | *(1852)* | teste. SCHURIAN, 1*984*' (on red paper);
- 2♂ with circles of bluish-green locality label paper and handwritten (Schurian) labels on printed lined form '*Paralectotypus* ♂ | *[Lycaena]* | *corydon hispana* | *H.-S. 1852* | *det. Schurian* 1*988*' (on white paper) — Schurian (1988: 133).

The paper of Schurian (*op. cit.*) contains no evidence that a lectotype (and paralectotypes) have been selected from Herrich-Schäffer's syntypes. — The lectotype designation is unavailable and the specimen designated as such by Schurian (1988: 132) loses its status of lectotype (ICZN Art. 74.2).

hopfferi Herrich-Schäffer, [1851]

'[*Lycaena*] *Hopfferi*' Herrich-Schäffer, [1851] **1**(49): Tab. 107, Figs 512–514; [1851] **6**(48): 24. Type locality: 'Aus Kleinasien; von Herr Kindermann'.

Syntypes ♂, ♀:

- ♂ with labels: handwritten 'Hopfferi | Kind.[ermann] ms. HSch. f | 512–14. Gerh. t. 21. f. 2 | Amasia Kind[ermann]' (recto yellow, in printed box, verso white), printed '4721' (on white paper);

- ♀ without any label.

Catalogus Generalis: 4721 — see Appendix; cf. Häuser & Eckweiler (1997: 80).

The specimens are provided now with a printed label '*hopfferi* Herrich-Schäffer, [1851] | SYNTYPUS | Y. Nekrutenko det. 30.11.1998' (on yellow paper).

hunza Groum-Grshimaïlo, 1890

'*Lycaena Hunza* Gr. Gr.' Groum-Grshimaïlo, 1890: 397, pl. 15, fig. 2. Type locality: 'La *Lyc. Hunza* vole tout le long de la rivière Mazar, qui prend sa source dans les monts Moustag (Himalaya occidental), sur le col Beïk et un peu au-dessous de celui-ci dans les monts Kounjout (là elle est moins typique). Altitude de 12,700 p. (Kourgan-Goudjabaï et l'embouchure du Mazar), à 15,500 p. (Beïk). ... Juin et commencement de Juillet.'

Syntypes ♂, ♀:

- ♂ with labels: handwritten (Groum-Grshimaïlo, in Russian) 'Ak Su' | 20.7.[18]87' (on white paper), printed 'Transalai' (on white paper faded yellow, in box), printed 'Grumm-Grsh.' (on white paper, in box), handwritten (Püngeler) 'hunza ♂ | Cotype <underlined> | 11./[19]09 ex coll. | Dieckmann' (on white paper) and handwritten (Püngeler) on printed form 'Cotype <underlined> | hunza Gr.Gr. ♂ | Püngeler' (on pink paper);
- ♀ with labels: handwritten '185' (on white paper), printed 'Transalai' (on white paper faded yellow, in box), printed 'Grumm-Grsh.' (on white paper, in box), handwritten (Püngeler) 'hunza ♀ | Cotype <underlined>, 11./[19]09 | ex coll. | Dieckmann' (on white paper) and handwritten (Püngeler) on printed form 'Cotype <underlined> | hunza Gr.Gr. ♀ | Püngeler' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Stoliczkana Feld. | v. Hunza Gr. Gr.' (on white paper, in printed box).

hyacinthus Herrich-Schäffer, [1847]

'*Lycaena Hyacinthus*' Herrich-Schäffer, [1847] **1**(26): Tab. 72, Figs 345–348; [1852] **6**(55): 29. Type locality: 'Aus der Türkei'.

Types: not found.

hyrcana Lederer, 1869

'*Lycaena Hyrcana* Led.' Lederer, 1869: 78, Taf. 4, Figs 6, 7. Type locality: '...bei Astrabad in Persien...' (*op. cit.*: 73). — Junior primary homonym of *Lycaena hyrcana* Felder, 1860; replacement name: *Cupido morgiana* Kirby, 1871: 369.

Lectotype ♂:

- ♂ with labels: handwritten 'Lycaena | Hyrcana' (on white paper), 'Hadschyabad' (on white paper), printed 'Origin.' (on pink paper), printed 'Coll. Led.' (on white paper), handwritten (Nekrutenko) on printed form 'LECTOTYPUS ♂ | *hyrcana Led.* | Y. Nekrutenko design.' (on yellow paper) — Nekrutenko *in* Hesselbarth *et. al.* (1995: 612).

Paralectotypes ♂, 3♀:

- ♂, 3♀ with same handwritten locality label 'Hadschyabad' and printed 'Origin' (on pink paper), one paralectotype female with printed 'Coll. Led.' (on white paper) but without locality label, handwritten (Nekrutenko) on printed form 'PARALECTOTYPUS ♂ (♀) | *hyrcana Led.* | Y. Nekrutenko design.' (on yellow paper).

***hyrcana* Neuburger, 1903**

'*Chrysophanus ochimus* H.-S. var. *hyrcana* ♂ Neubgr.' Neuburger, 1903: 59. Type locality: 'Habitat: Hyrcania (Persia septentr.)'.

Syntype ♂:

- ♂ with labels: handwritten 'Persia | ♂' (on white paper faded yellow), handwritten (Püngeler) 'Chrysophanus | ochimus | v. hyrcana Neubgr.' (on white paper), a small square piece of white paper, printed 'Type' (on red paper).

***iberica* Staudinger, 1901**

'*Zephyrus* Dalm. *Quercus* L. v. *Iberica* Stgr.' Staudinger, 1901: 71. Type locality: 'Ib.[eria] c.[entralis] et m.[eridionalis], Maur.[itania]'.

Syntypes 2♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'Quercus var. | Iberica | Stgr.' (verso), (on white paper), handwritten 'Sn. Ildef.[onso] |

18[84] m.[ihi]' (on pale green paper) and small date label '27/7' (on white strongly faded brownish paper);

- ♂, 2♀ with circles of yellow locality label paper and small date labels '10/7' (♂), '25/7' and '28/7'.

Likewise most of the Staudinger species-group taxa becoming available after his death in 1900 (i. e. in Staudinger, 1901), the type specimens were not designated with characteristic 'Origin.' labels. As may be seen from the original description, the type locality statement was pretty broad, so that all forementioned specimens are labelled such as to fit Staudinger's meaning of the '*terra typica*' to constitute a syntype series.

The specimens are provided now with a printed label '*iberica* Staudinger, 1901 | SYNTYPUS | Y. Nekrutenko det. 30.11.1998' (on yellow paper).

ignitus Herrich-Schäffer, [1846]

'*Polyomm.*[*atus*] *ignitus* Bisch.' Herrich-Schäffer, [1846] **1**(13): 163. [1846] **1**(14): Tab. 69, Fig. 332; Type locality: 'Von Hrn. Wagner, von der Südseite des Ararat.' — Junior subjective synonym of *Polyommatus thetis* Klug, 1834 (Staudinger, 1871a: 8; 1901: 72).

Types: not found.

ignorata Staudinger, 1901

'*Lycaena* F. *Meleager* Esp. v. *Ignorata* Stgr. (Versicolor Stgr. in l.)' Staudinger, 1901: 86. Type locality: 'Taur.[us] m.[eridionalis] or.[ientalis] (Akbes).' — Junior subjective synonym of *Lycaena meleager versicolor* Heyne, [1895] (Hesselbarth *et al.*, 1995: 687).

Syntypes 6♂, 4♀:

- ♂ with labels: handwritten (Staudinger) 'v. Ignorata | Stgr. | Versicolor in l. (recto) | v. Versicolor | Stgr. in l. (verso)' (on white paper), handwritten 'Eibes | 18[94] Man.[issadjian]' (on yellow paper) and printed 'Origin.' (on pink paper);
- ♂ with circle of yellow locality label paper, small date label '11/6' and printed label 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Eibes | 18[94] Haradj.[?]' (on yellow paper) and printed 'Origin.' (on pink paper);

- 2♂ with circles of yellow locality label paper and printed label 'Origin.' (on pink paper);
- 4♀ with circles of yellow locality label paper and printed label 'Origin.' (on pink paper), one has a small date label '17/8';
- ♂ with labels: handwritten 'Asia min. | (Hadjin <sic> | Funke [18]91' (on white paper, in printed box) and handwritten (Püngeler) on printed form 'Cotype <underlined> | *v. ignorata Stgr.* ♂ | *vom Autor* | *Püngeler*' (on pink paper).

iliensis Staudinger, 1886

'*Pol.*[*yommatus*] *Phoenicurus* Led. var. *Iliensis* Stgr.' Staudinger, 1886: 203. Type locality: '...vom Kuldja-District...' (see also Rühl *in* Rühl & Heyne, [1893]: 207).

Lectotype ♂:

- ♂ with labels: brown paper circle, printed 'Origin.' (on pink paper), printed 'ex collect. | Staudinger' (on photographic paper) and printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Nekrutenko) on printed form in box 'Figurat | par Y. Nekrutenko in: | *Vestn. zool. 1984, 6:* | *tab. ex adv. p. 49*' (on white paper), handwritten (Nekrutenko) label 'iliensis Stgr. | Lectotypus | Y. Nekrutenko design. | 10.IX.1983' (on yellow paper) — Nekrutenko (1984: 47, pl. [2]).

Paralectotypes 6♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'var. Iliensis | Stgr.' (on white paper), handwritten 'Kuldja | 85 Rckbl. [Rückbeil]' (on brown paper), printed 'Origin' (on pink paper);
- ♂, 2♀ with circles of brown locality label paper and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten (Staudinger) 'Phoenicurus var. | Iliensis |Stgr.' (on white paper), handwritten 'Kuldja | Alph.[éraky]' (on brown paper), handwritten (Alphéraky) date label '13/5' (on white paper, in pencil) and printed 'Origin' (on pink paper);
- 3♂ with circles of brown locality label paper and printed 'Origin.' (on pink paper); one has also handwritten (Alphéraky) date label '13/5' (on white paper, in pencil).

iphicarmon Eckweiler & Rose, 1993

'*Polyommatus (Agrodiaetus) iphigenia iphicarmon* ssp. nov.' Eckweiler & Rose, 1993: 360, Abb. 13–19. Type locality (holotype): 'Türkei, Isparta, Eğridir, Aksu, Dedegöl Dağ, 1500–1800 m'.

Paratypes 2♂:

- 2♂ with printed labels: 'Türkei, Isparta | Egridir/Aksu | Dedegöl Dag | 1500-1800 m | 23.-25.VII.1991 | leg. Eckweiler' (on white paper) and '**Paratypus** ♂ | *Polyommatus (Agrodiaetus)* | *iphigenia* ***iphicarmon*** | Eckweiler & Rose 1993' (on red paper) — see also Häuser & Eckweiler (1997: 81); Eckweiler & Häuser (1997: Pl. 8).

iphicles Staudinger, 1886

'*Lyc.*[*aena*] *Iphicles* Stgr.' Staudinger, 1886: 227. Type locality: '...(Haberhauer sandte sie mir als Jolas), erhielt ich nur 3 im Alai (am 13. Juni) gefangene ♂, ein am 10. Juni bei Osch gefangenes ♂ und 2 am 6. Juli bei Samarkand (in den Gebirgen) gefangene ♀.' — Junior subjective synonym of *Lycaena gigantea* Groum-Grshimailo, 1885 (Staudinger, 1901: 88).

Syntypes 4♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'Iphicles | Stgr.' (on white paper), handwritten 'Alai | [18]85 Hbhr. [Haberhauer]' (on brown paper), printed 'Origin.' (on pink paper);
- 2♂ with circles of brown locality label paper and printed label 'Origin.' (on pink paper); one of them has a handwritten (Haberhauer?) label 'Iolas 16/6' (on white faded paper, in violet ink) — see *Type locality* section above;
- ♂ with labels: handwritten 'Osch | Hbhr. [Haberhauer]' (on brown paper), handwritten '32.', handwritten date label '10/6' and printed 'Origin.' (on pink paper);
- ♀ with labels: handwritten 'Prov. Samark.[and] | Hbhr. [Haberhauer] [18]81' (on brown paper), and printed 'Origin.' (on pink paper);
- ♀ with circle of brown locality label paper, small date label '6/7' (on white paper, in pencil) and printed label 'Origin.' (on pink paper).

iphidamon Staudinger, 1899

'[*Lycaena*] *Damone* Ev. var. *Iphidamon*' Staudinger, 1899: 144. Type locality: 'bei Stücken aus Nord-Persien'; restricted by the lectotype designation: 'Schahkuh'.

Lectotype ♂:

- ♂ (abdomen missing), with labels: handwritten 'Schakuh | Chr.[istoph]' (on yellow paper), a circle of green paper, printed '315.' (on white paper faded brown), handwritten (Forster) on printed form '*Lecto*-Typus ♂ | *Polyommatus iphigenia* | *iphidamon Stgr.* | W. Forster München' (on pink paper) — Forster (1960: 118); Häuser & Eckweiler (1997: 81); Eckweiler & Häuser, 1997: Pl. 8).

Paralectotypes 8♂, 2♀:

- ♂ with labels: handwritten 'Hadsch. | Chr.[istoph]' (on yellow paper), date label '26/6' (on dark-green paper) printed '316.' (on white paper faded brown), handwritten (Forster) 'Cotypus ♂ | *Lycaena damone Ev.* | *iphidamon Stgr.*' (on pink paper);
- ♂ with a circle of yellow locality label paper and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Schakuh | Chr.[istoph]' (on yellow paper), printed '311.' (on white paper faded brown), handwritten (Forster) on printed form '*Polyommatus* | *(Agrodiaetus)* ♂ | *iphigenia* | *iphidamon Stgr.* | det. W. Forster 1947' (on white paper);
- ♀ with labels: handwritten 'Astrabad' (on white paper), printed '312.' (on white paper faded brown), printed, with handwritten insertion 'Coll. Led. | *Iphigenia'* (on white paper), handwritten (Forster) on printed form '*Polyommatus* | *(Agrodiaetus)* ♀ | *iphigenia* | *iphidamon Stgr.* | det. W. Forster 1947' (on white paper);
- ♂ (abdomen missing), with labels: handwritten 'Hadsch. | Hbhr. [Haberhauer]' (on yellow paper), printed '317.' (on white paper faded brown), printed 'Origin.' (on pink paper), handwritten (Forster) 'Cotypus ♂ | *Lycaena damone Ev.* | *iphidamon Stgr.*' (on pink paper);

- ♂ with labels: handwritten 'Astrabad' (on white paper), printed '310.' (on white paper faded brown), printed 'Coll. Led.' with insertion 'Damon' (on white paper), printed 'Origin.' (on pink paper), handwritten (Forster) 'Cotypus ♂ | *Lycaena damone Ev.* | *iphidamon Stgr.*' (on pink paper);
- ♂ with labels: handwritten 'Hyrcania | Chr.[istoph] (on yellow paper), printed 'Origin.' (on pink paper), printed '309.' (on white paper faded brown), handwritten (Forster) 'Cotypus | *Lycaena* | *damone* | *iphidamon Stgr.*' (on pink paper);
- ♀ with labels: with a circle of yellow locality label, small date label '1/6' (on white paper), small date label '17/6' (on white paper faded brown), printed '313.' (on white paper faded brown), printed 'Origin.' (on pink paper), handwritten (Forster) 'Cotypus ♂ <sic> | *Lycaena damone* | *Ev.* | *iphidamon Stgr.*' (on pink paper), handwritten (Forster) on printed form '*Ne-* Allo-Typ*us* <corrected Type>, ♀ | *Polyommatus (Agrodiaetus)* | *iphigenia iphidamon* | *Stgr.* | W. Forster München' (on pink paper);
- 2♂, one with labels: handwritten 'Hadschyabad' (on white paper), printed, with handwritten insertion 'Coll. Led. | *Iphigenia'* and printed 'Origin.' (on pink paper), another with a circle of yellow locality label paper and printed 'Origin.' (on pink paper) is placed at the series end under a handwritten (Staudinger) drawer label 'ab. Transcaspica | Stgr.' (on white paper).

iphigenia Herrich-Schäffer, [1847]

'*Lycaena Iphigenia* Friv.[aldszky]' Herrich-Schäffer, [1847] **1**(26): Tab. 73, Fig. 354; [1851] **6**(48): 24. Type locality: 'Aus der Türkei'.

Syntypes 2♂, 2♀:

- ♂ with labels: handwritten 'Iphigenia | Friv.[aldszky] HSch. f. 354 | Gerh.[ard] | t. 20. f. 2. Frey.[er] | Constantinop.[el] Friv.[aldszky]' (on white paper, in printed box) and printed '4724' (on white paper);
- ♂, 2♀ without any label.

Catalogus Generalis: 4724 — see Appendix; cf. Häuser & Eckweiler (1997: 81).

The specimens are provided now with a printed label '*iphigenia* Herrich-Schäffer, [1847] | SYNTYPUS | Y. Nekrutenko det. 11.12.1998' (on yellow paper).

iphigenides Staudinger, 1886

'*Lyc.*[*aena*] *Kindermanni* Ld. ... var. *Iphigenides* Stgr.' Staudinger, 1886: 213. Type locality: 'nur 4 reine ♂ erhielt, von denen 3 Ende Mai bei Namangan, das vierte in den Gebirgen bei Margelan gefunden ist'; restricted by the lectotype designation: Namangan.

Lectotype ♂:

- ♂ with labels: handwritten (Staudinger) 'var. Iphigenides | Stgr.' (on white paper), handwritten 'Namangan | Hbhr. [Haberhauer] [18]84' (on brown paper), printed 'Origin.' (on pink paper), handwritten (Forster) on printed form '*Lecto*-Typus ♂ | *Polyommatus (Agrodiaetus)* | *iphigenia iphigenides Stgr.* | W. Forster München' (on pink paper) — Forster (1960: 122); Häuser & Eckweiler (1997: 82).

Paralectotypes 3♂:

- ♂ with labels: handwritten 'Margelan | Maur.[er] [18]84' (on brown paper) and printed 'Origin.' (on pink paper);
- ♂ with labels: a circle of locality label brown paper, printed 'Origin.' (on pink paper) handwritten (Forster) 'Cotypus ♂ | Lycaena kinder- | manni | var. iphigenides | Stgr.' (on pink paper), handwritten (Forster) on printed form '*Polyommatus* | *(Agrodiaetus)* | *iphigenia* | *iphigenides Stgr.* | det. W. Forster 1947' (on white paper).

iris Staudinger, 1886

'*Lyc.*[*aena*] *Iris* Stgr.' Staudinger, 1886: 207. Type locality: 'aus den Gebirgen bei Margelan und Samarkand, wo sie im Juli gefanden wurde.' — Junior primary homonym and junior objective synonym of *Lycaena iris* H. C. Lang, 1884; replacement name *Polyommatus neoiris* Tshikolovets (1997a: 139) is a junior objective synonym of *Lycaena iris* H. C. Lang, 1884.

Syntypes 9♂, 3♀:

- ♂ with labels: handwritten (Staudinger) 'Iris | Stgr.' (on white paper), 'Margelan | Hbhr. [Haberhauer]' (on brown paper) and '8/7' (on white paper) and printed 'Origin.' (on pink paper);

- 3♂ with handwritten date labels, '10/7 [18]80', '16/7', '12/7' (on white paper) and printed 'Origin.' (on pink paper);
- ♀ with circle brown locality label paper and printed label 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Prov. Samark.[and] | Hbhr. [Haberhauer] [18]81' (on brown paper), small handwritten date label '20/7' (on white paper) and printed 'Origin.' (on pink paper);
- 4♂, 2♀ with circles of brown locality label paper, printed label 'Origin.' (on pink paper), and some with small date labels '12/V', '6/5' (on white paper), (figured in Tshikolovets, 1997a: 139, 238, pl. 40, figs 15(17; 1997b: 37, figs 7–10); one male specimen also has a handwritten (Staudinger) label 'Iris' (on white paper).

isaurica Staudinger, 1871

'*Lycaena Isaurica* Lederer in coll.' Staudinger, 1871b: 327. Type locality: '[Lederer] fing diese Stücke [4♂] bei Karli Boghas im Taurus, im südlichen Kleinasien'.

Syntypes 3♂, ♀:

- ♂ with labels: handwritten (Lederer) 'Isaurica | m.[ihi]' (on white paper, in printed box), handwritten 'Karli Boghas' (on white paper), printed 'Origin.' (on pink paper); printed 'Zool. Mus. | Berlin' (on pale yellow paper), printed, with handwritten (Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *105* Figur *1*' (on white paper);
- ♂ with labels: handwritten 'Karli Boghas' (on white paper), printed 'Coll. Led.' (on white paper), printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Taurus | Ld. [Lederer]' (on yellow paper), printed 'Origin.' (on pink paper);
- ♀ with labels: handwritten 'Karli Boghas' (on white paper), printed 'Coll. Led.' (on white paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Wagener) 'Lycaena | isaurica | Stgr. 1871' (on white paper), printed, with

handwritten (Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *105* Figur *7*' (on white paper).

ismenias Klug, 1834

'*Lycaena Ismenias*' Klug, 1834, Decas Quarta: Signature *k*[iii], Taf. 40, Abb. 1, 2. Type locality: 'Prope Ambukohl mense Iulio semel capta'.

Types: not found; *Catalogus Generalis*: 4091 — see Appendix.

jordanus Staudinger, 1897

'*Jolaus Jordanus* Stgr. n. sp.' Staudinger, 1897: 153, Taf. 5, Fig. 5. Type locality: '...wurde vor einigen Jahren von Herrn Paulus im Jordanthal (Paläastina) entdeckt...'

Syntypes 2♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'Jolaus ? | Jordanus | Stgr.' (on white paper), handwritten 'Jordanthal | [18]95 Paulus' and printed 'Origin.' (on pink paper);
- ♂, 2♀ with printed 'Palaes- | tina' (on white paper) and printed 'Origin.' (on pink paper); one female specimen also has a handwritten label (Staudinger) 'Jolaus | Jordanus ♀' (on white paper).

juennana Forster, 1940

'*Glaucopsyche* (*Phengaris*) *atroguttata juennana* ssp. nov.' Forster, 1940: 877. Type locality (holotype): 'China, Jünnan, Umgebung von Tali'.

Holotype ♂:

- ♂ with labels: printed, with handwritten insertion 'China Yunnan | *Tali* | *6.9.*[19]*14*, | R. Mell' (on white paper), handwritten (Forster) on printed form 'Holo-Type | *Phengaris atroguttata* | *ssp. yuennana* <sic> *Forst.*' | W. Forster München' (on pink paper), handwritten (Mell) field label 'Tali <illegible> | 6.IX.[19]14 | <illegible> (recto) | <text in Chinese> (verso)' (on poor quality paper, in pencil, folded).

Allotype ♀:

- ♀ with labels: printed, with handwritten insertion 'China Yunnan | *Tali* | *23.9.*[19]*14*, | R. Mell' (on white paper), handwritten (Forster) on printed form 'Allo-Type | *Phengaris atroguttata* | *ssp. yuennana* <sic> *Forst.*' | W. Forster München' (on pink paper), handwritten (Mell) field label 'Tali (J. 3 <illegible>) | 23.IX.[1914] <illegible> (recto) | <text in Chinese> (verso)' (on poor quality paper, in pencil, folded).

Paratypes 3♂:

- 3♂ with labels: printed, with handwritten insertion 'China Yunnan | *Tali* | *3., 7., 11.9.*[19]*14*, | R. Mell' (on white paper), handwritten (Forster) on printed form '*Para*-Typus | *Phengaris atroguttata* | *ssp. yuennana* <sic> *Forst.* | W. Forster München' (on pink paper); the paratypes also have handwritten (Mell) original field labels (on poor quality paper, folded).

For paratypes in Zoologisches Forschungsinstitut und Museum Alexander Koenig, see also Nekrutenko (1998: 133).

juldusa Staudinger, 1886

'*Lyc.*[*aena*] *Kindermanni* Ld. var. *Juldusa* Stgr.' Staudinger, 1886: 213. Type locality: '...von Alpheraki auf dem Juldus- (Tian Schan) Gebirge gefangene...'

Lectotype ♂:

- ♂ with a circle of brown locality label paper, printed 'Origin.' (on pink paper), handwritten (Forster) on printed form '*Polyommatus* | *(Agrodiaetus)* | *iphigenia* ♂ | *juldusa Stgr.* | det. W. Forster 1947' (on white paper), handwritten (Forster) on printed form '*Lecto*-Typus ♂ | *Lycaena kindermanni* | *juldusa Stgr.* | W. Forster München' (on pink paper, in box), handwritten (unknown hand) 'juldussa' (on white paper) — Forster (1960: 124); Häuser & Eckweiler (1997: 83); Eckweiler & Häuser (1997: Pl. 9).

Paralectotypes 7♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'var. Juldusa | Stgr.' (on white paper), handwritten 'Tian Schan | Alph.[éraky]' (on

brown paper), handwritten date label '15/VII' and printed 'Origin.' (on pink paper);

- 4♂, 2♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper), one male and one female specimen also have labels: handwritten (Forster) on printed form '*Polyommatus* | *(Agrodiaetus)* | *iphigenia* ♂ (♀) | *juldusa Stgr.* | det. W. Forster 19*47*' (on white paper) and handwritten on printed form 'Cotypus ♂ (♀) | *Lycaena kindermanni* | *juldusa Stgr.*' (on pink paper); one female specimen also has a date label '14/7').

juliae Kardakoff, 1928

'*Deudorix arata* Brem. *juliae* (subsp. nov.)' Kardakoff, 1928: 271, Taf. 7, Fig. 12. Type locality: 'Die von mir gesammelte Sommertiere stammen aus Wladiwostok, Russ.[ische] Insel, Narva [Narwa] und Barabasch'.

Syntypes 2♀:

- ♀ with labels: printed, with handwritten insertion 'Narva, S. Ussurigebiet | *23*.VI.[19]21 N. Kardakoff' (on white paper), printed 'Nachträgl. der | Coll. Püngeler | hinzugefügt' (on greyish paper), handwritten (Kardakoff?) 'Deudorix arata Brem. | v. juliae Kardakoff' (on white paper) and printed 'Typus' (on red paper, in box);
- ♀ with labels: printed, with handwritten insertion 'Sutschan, S. Ussurigb. | *3*.VI. <crossed, corrected to '6'> [19]21 N. Kardakoff' (on white paper), printed 'Nachträgl. der | Coll. Püngeler | hinzugefügt' (on greyish paper), handwritten (Kardakoff?) 'Deudorix arata Brem. | v. juliae Kardakoff' (on white paper) and printed 'Typus' (on red paper, in box).

kenteana Staudinger, 1892

'*Lyc.*[*aena*] *Cleobis* Brem. var. *Kenteana*' Staudinger, 1892d: 316. Type locality: 'Kentei'.— Junior subjective synonym of *Lycaena cleobis ida* Grum-Grshimaïlo, 1891 (Staudinger, 1901: 79).

Syntypes 4♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'var. | Kenteana | Stgr. (recto) | v. Ida GrGr. | v. Kenteana Stgr. (verso)' (on white

paper), handwritten 'Kentei | [18]89 Dörr.[ies]' (on green paper) and printed 'Origin.' (on white paper);

- 3♂, 2♀ with circles of green locality label paper and printed labels 'Origin.' (on pink paper).

kindermannii Lederer, 1852

'*Lycaena* * *Kindermannii* Gerh.[ard]' Lederer, 1852: 21 (nomen nudum; * designates 'was nicht echt europäisch' — *op. cit.*: 15); '*Lycaena Kindermannii*' Lederer, 1852: 37. Type locality: '...meine *Kindermannii* aus der Gegend von Amasia.' — Junior subjective synonym of *Lycaena carmon* Herrich-Schäffer, [1851] (Staudinger, 1899: 139).

Syntypes 2♂, ♀:

- ♂ with labels: handwritten 'Kindermani <sic> | Gerh.[ard] 2 ♂' (on white paper), handwritten 'Amasia' (on white paper) and printed, with handwritten insertion '*Kindermani* <sic> | Coll. Led.' (on white paper);
- ♂ with printed label with handwritten insertion '*Kindermanni* | Coll. Led.' (on white paper);
- ♀ with labels: handwritten 'Amasia' (on white paper), printed, with handwritten insertion'*Kindermanni* | Coll. Led.' (on white paper).

This species-group taxon was unintentionally named as presumed to be published by Gerhard but actually it was not (cf. Häuser & Eckweiler, 1997: 85). The first of forementioned specimens has a label exactly showing its relation to Gerhard; the others were labelled with 'Coll. Led.' after Lederer's collection was acquired by Staudinger, and insertions on printed labels made in the same writing characters as accepted in the Staudinger collection may show that they were designated in some way in the collection of Lederer.

The specimens are placed under a handwritten (Staudinger) drawer label 'Carmon HS. | Kindermanni | Ld.' (on white faded paper); each provided now with a printed label '*kindermannii* | Lederer, 1852 | SYNTYPUS | Y. Nekrutenko det. 10.11.1998' (on yellow paper).

kogistana Grum-Grshimaïlo, 1888

'*Lycaena kogistana* m.' Grum-Grshimaïlo, 1888: 306. Type locality: 'Darwaz'.

Syntype ♂:

- ♂ with labels: handwritten (Staudinger) 'Kogistana Grum. | Agwai-Polusali Pass | Darwas Geb.[irge].' (on white paper), handwritten 'Darwas | [18]85 Gr.[um] Gr.[shimaïlo]' (on brown paper), handwritten (Grum-Grshimaïlo?, in Russian) 'Karysen <hardly legible>' (on white paper) and small handwritten (Grum-Grshimaïlo) date label '4.VI | [18]85.' (on white paper).

In evidence that this specimen, forwarded by Grum-Grshimaïlo to Staudinger, belongs to the type series, a quotation from a subsequent publication by the author (redescription and type locality restriction) follows: 'Elle n'a été trouvée qu'une seule fois, près du col Agwaï-Polousak, où elle volait sur des clairières d'"artcha" [*Juniperus* sp.] (près de 9,500 p.). Commencement de Juin' (Groum-Grshimaïlo, 1890: 407, pl. 8, fig. 6a, 6b).

The specimen is provided now with a printed label '*kogistana* | Grum-Grshimaïlo, 1888 | SYNTYPUS | Y. Nekrutenko det. 16.11.1998' (on yellow paper).

korlana Staudinger, 1901

'*Lycaena* F. *Prosecusa* Ersch. v. *Korlana* Stgr.' Staudinger, 1901: 90. Type locality: 'Tian.[schan] c.[entralis] m.[eridionalis] (Korla)' '*sec.*[*undum*] 3 ♀♀ *descripta*' – *l. c.*

Syntype ♀:

- ♀ with handwritten (Staudinger) labels 'Prosecusa var.? | Korlana Stgr.', 'von Korla' (both on white paper) and a square piece of pink paper.

The specimen is provided now with a printed label '*prosecusa korlana* | Staudinger, 1901 | SYNTYPUS | Y. Nekrutenko det. 10.11.1998' (on yellow paper).

kwangtungensis Forster, 1942

'*Zephyrus kwangtungensis* spec. nov.' Forster, 1942: 570, Taf. 16. Type locality (holotype): 'China, Kwangtung, Lung tao shan'.

Holotype ♂:

- ♂ with labels: printed, with handwritten insertion 'China Kwantung | *Lung tao Shan* | *3.5*.[19]*18*, | R. Mell' (on white paper), handwritten (Forster) on printed form 'Holo-Type <corrected to 'Typ*us*'> ♂ | *Zephyrus* | *kwangtungensis Forst.* | W. Forster München' (on pink paper);

Paratypes 2♂:

- 2♂ with labels: printed, with handwritten insertion 'China Kwantung | *Lung tao Shan* | *3.8* [19]*18* and *7.5*.[19]*17* | R. Mell' (on white paper), handwritten (Forster) on printed form 'Para-Typus ♂ | *Zephyrus* | *kwangtungensis Forst.* | W. Forster München' (on pink paper); both have also handwritten (Mell?) original field labels (one in Chinese) (on poor quality paper, folded).

laetifica Püngeler, 1898

'*Lycaena cyllarus* Rott. var. *laetifica*. m.' Püngeler, 1898: 57. Type locality: 'Hab.[itat] Ili flimen.' later on redescribed as a species '*Lycaena laetifica* m.' Püngeler, 1899: 95. Type locality: 'Beschrieben nach 3 ♂♂ 1 ♀ aus dem Ili-Gebiet'.

Syntypes 2♂, ♀:

- ♂ with labels: printed, with handwritten (Püngeler) insertion 'Asia centr.[alis] | *(Ili)* | *Rückbeil 1897*' (on white paper) and handwritten (Püngeler) on printed form 'Type <double underlined> | *laetifica Püng.* ♂ | *Püngeler*' (on pink paper);
- ♂, ♀ with labels: printed, with handwritten (Püngeler) insertion 'Asia centr.[alis] | *(Ili)* | *Rückbeil 1897*' (on white paper) and handwritten (Püngeler) on printed form 'Cotype <underlined> | *laetifica Püng.* ♂ (♀)| *Püngeler*' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Cyllarus Rott. | v. Laetifica Püng.' (on white paper, in box); the holotype designation (as 'Type') has not been published.

lampon Lederer, 1870

'*Polyommatus Lampon* Led.' Lederer, 1870b: 8, Taf. 1, Figs 2, 3. Type locality: '...bei Astrabad in Persien... ...von Hirten bewohnte Dorf Hadschyabad...' (op. cit.: 3, 4).

Syntypes 2♂, 2♀:

- ♂ with labels: handwritten 'Hadschyabad' (on white paper) and printed 'Origin.' (on pink paper);
- ♀ with printed labels: 'Origin.' (on pink paper) and 'Coll. Led.' (on white paper);
- ♂, ♀ with labels: handwritten 'Hadschyabad' (on white paper), printed 'Origin.' and printed 'Eigentum | Collection | Staudinger' (both on pink paper).

lamponides Staudinger, 1901

'*Chrysophanus* Hb. *Lampon* Ld. v. *Lamponides* Stgr.' Staudinger, 1901: 73. Type locality: 'Pers.[ia] s.[eptentrionale] (Schahrud).

Syntypes 4♂, 2♀:

- ♂ with labels: handwritten 'Schahrud | Chr.[istoph]' (on yellow paper), small handwritten label '17/5' and printed 'Origin.' (on pink paper);
- 3♂, 2♀ with circles of yellow locality label paper.

The specimens are placed under a handwritten (Staudinger) drawer label 'v. Lamponides | Stgr.'

latedisjuncta Alberti, 1973

'*L.*[*ycaena*] *pyrenaica latedisjuncta* n. subsp.' Alberti, 1973: 221. Type locality: '...mit Holotypus ♂ und typischer Population vom Kasbek'.— Junior subjective synonym of *Lycaena dardanus* Freyer, [1843] (Hesselbarth *et al.*, 1995: 622).

Types ('...einige Paratypen auch im Zoologischen Museum Berlin...' — *op. cit.*: 221): not found.

lederi A. Bang-Haas, 1907

'*Lycaena lycormas* Btl. v. *lederi* n. var.' Bang-Haas, A., 1907: 69. Type locality: 'Aus dem Sajangebiete (Munku) erhielt ich eine Anzahl männlichen Stücke...'

Syntypes 3♂:

- ♂ with labels: handwritten (O. Bang-Haas) 'Lyc.[aena] Lycormas | v. Lederi | BH. | (Sajan M.[ontes])' (on white paper),

handwritten (O. Bang-Haas) 'Sajan | M.[ontes]' (on white paper) and handwritten 'Orig.' (on pink paper);

- 2♂ with labels: printed 'Sajan' (on white paper) and handwritten 'Orig.' (on pink paper).

livia Klug, 1834

'*Lycaena Livia*' Klug, 1834: Decas Quarta: Signature *k*(iii), Tab. 40, Figs 3, 4 <in text; figured figs 3–6>. Type locality: [Egypt] 'Patria: inter Kineh [Kineh, Qena] et Assuan [Aswân] Novembre'.

Syntypes 2♂:

- ♂ with labels: handwritten 'Livia | Kl.[ug] Symb.[olae] t.[abula] 40 f.[igurae] 3–6 | Arab.[ia] fel.[ix] Ehrbg. [Ehrenberg]' (recto yellow, in printed box, verso white), printed '4117' (on white paper);
- ♂ with labels: handwritten 'Aegypt | Ehrbg. [Ehrenberg]' (on dirty green paper), printed '4118' (on white paper).

Catalogus Generalis: 4117, 4118 — see Appendix.

The specimens are provided now with a printed label '*livia* Klug, 1834 | SYNTYPUS | A. Olivier & Y. Nekrutenko det. 30.11.1998' (on yellow paper).

lorestanus Eckweiler, 1997

'*Polyommatus (Agrodiaetus) demavendi lorestanus* subsp. nov.' Eckweiler, 1997: 8, Farbtafel 1. Type locality (holotype): 'Iran, Lorestan, Dorud, Saravand, 2000–2300 m'.

Paratypes 2♂, ♀:

- 2♂, ♀ with printed labels: 'Iran/Lorestan | Dorud/Saravand | 2.-5.VIII.1979 | leg. GÖRGNER' (on white paper) and '**Paratypus** ♂ (♀) | *Polyommatus (Agrodiaetus)* | *demavendi* ***lorestanus*** | **subsp. nov.** | Eckweiler, 1997' (on bluish paper, in box) — see also Häuser & Eckweiler (1997: 87).

lorquinii Herrich-Schäffer, [1850]

'*Lyc.*[*aena*] *Lorquinii*' Herrich-Schäffer, [1850] **1**(43): Tab. 92, Figs 442–444; [1852] **6**(55): 25. Type locality: not stated: 'Ein Pärchen von Herr Keferstein'.

Types: not found.

lucifera Staudinger, 1867

'*Lycaena lucifera* Kinderm. in litt.' Staudinger, 1867: 100. Type locality: '...findet sich in nur einem männlichen Exemplar in Gruner's Sammlung... und stammt aus Ust-Kamenogorsk im Altai (westliches Sibirien)'.

Holotype ♂ (by monotypy): not found (see also Forster, 1941: 74–77, Taf. 2, Fig. 12, Taf. 3, Fig. 12).

lusitanica Staudinger, 1892

'*Laeosopis Roboris* Esp. var *Lusitanica* Stgr.' Staudinger, 1892a: 232. Type locality: '...ein solches ♂ am 6. Juni [18](84) bei Lissabon und besitzte noch ein anderes Stück dort; Herr Max Korb fand diese var. *Lusitanica* in Anzahl und in sehr typischen Stücken in Algarbien im südlichen Portugal'.

Syntypes 3♂, ♀:

- ♂ with labels: handwritten (Staudinger) 'var. Lusitanica | Stgr.' (on white paper), handwritten 'Lusitania | Eaton' (on yellow paper) and printed 'Origin.' (on pink paper);
- ♂ with labels, handwritten (Staudinger) 'Lissabon | [18]84 m.[ihi]' (on yellow paper), handwritten on printed form '*Visto y dibujado* | *en 1959* | R. AGENJO det.' (on white paper), small handwritten <illegible>, and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten (Staudinger) 'Algarbia | Korb' (on yellow paper) and printed 'Origin.' (on pink paper);
- ♀ with a small square piece of yellow paper and printed 'Origin.' (on pink paper).

maculifera Staudinger, 1892

'*Thestor Romanovi* Christ. var. *Maculifera* Stgr.' Staudinger, 1892a: 233. Type locality: 'Mardin in Mesopotamien.' — Junior subjective synonym of *Thestor romanovi* Christoph, 1882 (Hesselbarth *et al.*, 1995: 506).

Syntypes 6♂, 7♀:

- ♂ with labels: handwritten (Staudinger) 'var. Maculifera | Stgr.' (on white paper), handwritten 'Mardin | [18]91 Manis.[sadjian]' (on yellow paper), printed 'Origin.' (on pink paper);

- 5♂, 7♀ with circles of yellow locality label paper and printed 'Origin.' (on pink paper), one of the male specimens also has a handwritten (Staudinger) label 'var. Maculifera | Stgr.' with an insertion in pencil 'Mardin' (on white paper), some also with small date labels, not always legible.

mandschurica Staudinger, 1892

'*Lycaena Astrarche* Brgstr. var. *Mandschurica*' Staudinger, 1892b: 161. Type locality: 'Diese *Mandschurica* erhielten wir in Anzahl von Herz, der sie im nördlichen China bei Ta-schiao-sy (nördlich von Peking) von Anfang Juni bis Ende Juli fand...' — Junior subjective synonym of *Lycaena chinensis* Murray, 1874 (Staudinger, 1901: 83).

Syntypes 3♂, 3♀:

- ♂ with labels: handwritten (Staudinger) 'Myrmecias | var. Mandschurica | Stgr.' (on white paper), and 'Peking | [18]85 Herz' (on white paper), small handwritten date label '15/6', printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten (Staudinger) 'Myrmecias var. | Mandschurica | Stgr.' (on white paper), circle of white paper, small handwritten date label '9/6', printed 'Origin.' (on pink paper);
- ♂, 3♀ with circles of white locality label paper, small handwritten date labels '8/6', '10/7', '28/7' and printed labels 'Origin.' (on pink paper).

maraschi Forster, 1956

'*Agrodiaetus damone maraschi* ssp. nov.' Forster, 1956: 57. Type locality (holotype): 'Syria sept., Taurus, Marasch'.— Junior subjective synonym of *Agrodiaetus damone wagneri* Forster, 1956 (Hesselbarth *et al.*, 1995: 729).

Paratype ♂:

- ♂ with labels: handwritten 'Taurus | Karli Boghas | 1895 (recto) | Lycaena | actis HS. ♂ | E. Funke 1.[18]96 (verso)' (on white paper, recto in printed box) and handwritten (Forster) on printed form 'Para-Typus ♂ | *Agrodiaetus damone* | *maraschi Forster* | W. Forster München' (on pink paper, in box) — see also Häuser & Eckweiler (1997: 88).

marchica Hannemann, 1928

'*Chrysophanus amphidamas marchica*' Hannemann, 1928: 110. Type locality: 'Strausberg [bei Berlin]'.

Syntypes 3♂, 2♀:

- 3♂, 2♀ with labels: handwritten (Hannemann?) '15.7.[19]28 | Strausberg | E. Hañemañ <sic> (on white paper) and printed 'Paratypus' (on pink paper).

The specimens are placed under a handwritten (Herring) drawer label 'Lycaena | amphidamas | marchica Hann.' and (on the same pin) printed 'Paratype' (on pink paper). Since the original description contains no holotype designation (the type material is referred to as 'Typen'), these specimens are to be considered as syntypes (subsequent designation with labels 'Paratypus' by Herring is apparent).

marcida Lederer, 1870

'*Lycaena Marcida* Led.' Lederer, 1870b: 10, Taf. 1, Fig 8. Type locality: '...bei Astrabad in Persien... Nur 2 Männchen erhalten...' (op. cit.: 3).

Syntypes 2♂:

- ♂ with labels: handwritten (Lederer) 'Marcida | m.[ihi]' (on white paper, in printed box), and 'Hadschyabad' (on white paper), printed 'Eigentum | Collection | Staudinger' (on pink paper), printed 'Origin.' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper);
- ♂ with labels: handwritten 'Hadschyabad' (on white paper), printed 'Coll. Led.' (on white paper), printed 'Origin.' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Schurian) note on a piece of paper 'Hybrid: daphnis brandti × marcida Led. det. Schurian 1992'.

margelanica Staudinger, 1881

'*Polyomm.*[*atus*] *Dimorphus* Stgr. n. sp. ...var. *Margelanica*' Staudinger, 1881: 282. Type locality: '...die größere Margelan-Varietät, die ganz gut als var. *Margelanica* bezeichnet werden kann...'

Lectotype ♂:

- ♂ with labels: circle of brown paper, handwritten '30/5 80' (on white-yellowish paper, in black ink), printed 'Origin.' (on pink paper), printed 'ex collect. | Staudinger' (on photographic paper), printed 'Zool. Mus. | Berlin' (on yellow paper), handwritten (Nekrutenko) on printed form 'Figurat | par Y. Nekrutenko in: | *Vestn. zool. 1984, 6:* | *tab. ex adv. p. 48*' (on white paper, in box), handwritten (Nekrutenko) 'margelanica Stgr. | Lectotypus | Y. Nekrutenko design. | 10.IX.1983' (on yellow paper) — Nekrutenko (1984: 44, pl. [1]).

Paralectotypes 6♂, 7♀:

- ♂ with labels: handwritten 'Margelan | Hbhr. [Haberhauer]' (on brown paper) and printed 'Origin' (on pink paper);
- 5♂, 7♀ with circles of brown locality label paper and printed 'Origin' (on pink paper).

marpurgica Strand, 1919

'*Lycaena argus* L. cum ab. *marpurgica* Strand n. ab.' Strand, 1919: 18. Type locality: 'Marburg.' — Infrasubspecific.

Syntypes 3♀:

- 3♀ with labels: printed 'Deutschland | Marburg i.[n] H.[essen] | E. Strand, 7.04[1904].' (on white paper), handwritten (Strand) '*Lycaena* | *argus L.* | Strand det. | *ab. marpur-* | *gica m* ♀' (on stiff white paper, printed line is glued on the middle part of the label); one specimen has a printed label 'Type' (on dirty-pink paper), two other have the same printed labels, with handwritten (Strand) insertion '*Co*-Type'.

***mauretanica* Staudinger, 1892**

'*Thecla Ilicis* Esp. v. *Mauretanica* Stgr.' Staudinger, 1892c: 279. Type locality: 'Ein ♂ von Tunis stimmt mit Stücken aus Collo (Prov. Constantine)...'

Syntypes 5♂, ♀:

- ♂ with labels: handwritten (Staudinger) 'var. | Mauretanica | Stgr.' (on white paper), handwritten 'Tunis | [18]91 Vaulog.' (on white paper) and printed 'Origin.' (on pink paper);

- ♂ with labels: handwritten 'Collo | Seriz' (on yellowish paper) and printed 'Origin.' (on pink paper);
- 3♂, ♀ with circles of yellowish locality label paper and printed labels 'Origin.' (on pink paper).

maxima O. Bang-Haas, 1927

'*Lycaena cyane maxima* O. B.-Haas, subsp. nov.' O. B.-Haas, 1927: 52, Taf. 7, Figs 24, 25. Type locality: 'China sept. or.: Kansu, Lanchowfu'.

Syntypes ♂, ♀:

- ♂ with labels: handwritten (O. Bang-Haas) 'Lyc.[aena] cyane | maxima O B Haas' (on white paper), printed 'Lanchowfu | Kansu' (on white paper), printed, with handwritten insertions 'Horae Macrolep. | Vol. I abgebildet | t. *7*, f. *24* | beschrieb. p. *52*' (on white paper), printed 'Type | O. Bang-Haas' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper);
- ♀ with labels: printed 'Lanchowfu | Kansu' (on white paper), printed, with handwritten insertions 'Horae Macrolep. | Vol. I abgebildet | t. *7*, f. *25* | beschrieb. p. *52*' (on white paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper).

maxima Staudinger, 1901

'*Cigaritis* B. *Cilissa* Ld. v. *Maxima* Stgr.' Staudinger, 1901: 76. Type locality: 'Kurd.[istan] oc.[cidentalis] (Malatia); Mesop.[otamia] s.[eptentrionale] (Mardin)'.

Syntypes 5♂, 3♀:

- ♂ with labels: handwritten (Staudinger) 'v. Maxima | Stgr.' (on white paper), handwritten 'Malatia | [18]84 Man.[issadjian]' (on yellowish paper), and small handwritten '18/6';
- 2♂, 2♀ with circles of yellowish locality label paper and small date labels '24/6', '16/6', '16/6' and '19/6';
- ♂ with handwritten label 'Mardin | [18]91 Manis.[sadjian]' (on yellow paper);
- ♂, ♀ with circles of yellow locality label paper.

The specimens are provided now with printed labels '*cilissa maxima* | Staudinger, 1901 | SYNTYPUS | Y. Nekrutenko det. 1998' (on yellow paper).

mayencis Eitschberger & Steiniger, 1975

'*Eumedonia eumedon mayencis* n. subsp.' Eitschberger & Steiniger, 1975: 106, Figs 13–24. Type locality: 'Deutschland, Rheinland-Pfalz, Mainz-Mombach, Mainzer Sand'.

Paratypes 3♂:

- 3♂ with labels: printed, with handwritten insertions 'Germania Mainz | Großer Sand | *26.5.*[19]*74* | leg. Schurian' (on white paper), printed 'PARATYPUS o <sex not stated> | Eumedonia eu- | medon mayencis | EITSCHBERGER & | STEINIGER, 1975' (on deep red paper).

melania Staudinger, 1886

'*Lyc.*[*aena*] *Kindermanni* Ld. ... var. *Melania* Stgr.' Staudinger, 1886: 213. Type locality: '...nur 2 frische ♂ aus dem südlichen Alai erhielt...'

Syntypes 2♂:

- ♂ with labels: handwritten (Staudinger) 'var. Melania | Stgr.' (on white paper), handwritten 'Alai | [18]85 Hbhr. [Haberhauer]' (on brown paper), printed 'Origin.' (on pink paper), handwritten (Forster) on printed form '*Polyommatus (Agrodiaetus)* ♂ | *iphigenia* | *iphigenides Stgr.* | *f. melania Stgr.* det. W. Forster 19*47*' (on white paper), handwritten (Häuser) on printed form '<u>SYNTYPUS</u> | *Lycaena* | *kindermanni* | *var.* | *melania* | *STAUDINGER* | det. Chr. L. Häuser | *VI.*[19]*94*' (on pink paper);
- ♂ with labels: circle of locality label brown paper, printed 'Origin.' (on pink paper) and handwritten (Häuser) on printed form '<u>SYNTYPUS</u> | *Lycaena* | *kindermanni* | *var.* | *melania* | *STAUDINGER* | det. Chr. L. Häuser | *VI.*[19]*94*' (on pink paper) — Häuser & Eckweiler (1997: 88–89); Eckweiler & Häuser (1997: Pl. 9).

melantho Klug, 1834

'*Lycaena Melantho*' Klug, 1834: Decas Quarta: Signature *k*(iv), Tab. 40, Figs 10, 11. Type locality: 'Habitat in Syria.' — Junior subjective synonym of *Papilio spini* Fabricius, 1787 (Hesselbarth *et al.*, 1995: 521).

Syntypes 2♂

- ♂ with labels: handwritten label 'Var. Melantho | Kl.[ug] Symb.[olae] t.[abula] 40 | f.[igurae] 10, 11 | Syria Ehrbg. [Ehrenberg]' (recto yellow, in printed dotted line box, verso white) and printed '4353' (on white paper);
- ♂ without any label.

Catalogus Generalis: 4353 — see Appendix.

The specimens are provided now with a printed label '*melantho* Klug, 1829 | SYNTYPUS | A. Olivier & Y. Nekrutenko det. 30.11.1998' (on yellow paper).

melibaeus Staudinger, 1878

'*Pol.*[*yommatus*] *Alciphron* Rott. (*Hipponoë* Esp.), *v. Melibaeus* Stgr.' Staudinger, 1878: 231. Type locality: 'Amasia und Bosz-Dagh'.

Lectotype ♂:

- ♂ with labels: handwritten 'Amasia' (on white paper), printed 'Coll. Led.' (on white paper), printed 'Origin.' (on pink paper), printed 'Zool. Mus. Berlin' (on white paper), handwritten (Lederer) 'V. Melibaeus | Kdm. ilit. <sic>' (on pale green paper, in printed box), handwritten (Wagener) on printed form 'Lectotypus | *Lycaena* | *alciphron* | *melibaeus* | P. S. Wagener' (on red paper, in box) — Wagener *in* Hesselbarth *et al.* (1995: 479, Taf. 127, Fig. 38).

Paralectotypes 3♂, 2♀:

- ♂ with labels: handwritten 'Amasia' (on yellow paper), printed 'Origin.' (on pink paper), printed 'Zool. Mus. Berlin' (on white paper), handwritten (Wagener) on printed form '*P*[ara]Lectotypus | *Lycaena* | *alciphron* | *melibaeus* | P. S. Wagener' (on red paper, in box);
- ♂ with labels: handwritten 'Bos Dagh' (on white paper), printed 'Coll. Led.' (on white paper), printed 'Origin.' (on pink paper), printed 'Zool. Mus. Berlin' (on white paper), handwritten (Wagener) on printed form in box '*P*[ara]-Lectotypus ♂ | *Lycaena* | *alciphron* | *melibaeus* | P. S. Wagener' (on red paper);

- ♀ with labels: handwritten 'Bos Dagh' (on white paper), printed 'Coll. Led.' (on white paper), printed 'Origin.' (on pink paper), printed 'Zool. Mus. Berlin' (on white paper), handwritten (Wagener) on printed form '*P*[ara]-Lectotypus ♀ | *Lycaena* | *alciphron* | *melibaeus* | P. S. Wagener' (on red paper, in box);
- ♂, ♀ with labels: handwritten 'Hadschyabad' (on white paper), printed 'Coll Led.' (on white paper), printed 'Origin.' (on pink paper) — these specimens, though labelled by Staudinger as 'Origin.[ale]', do not represent the type series;
- ♂ with labels: handwritten 'Szavalan | Persia Chr.[istoph]' (on yellow paper) and printed 'Origin.' (on pink paper);
- ♂, ♀ with circles of yellow paper and printed labels 'Coll Led.' (on white paper) and'Origin.' (on pink paper) — these specimens, though labelled by Staudinger as 'Origin.[ale]', do not represent the type series.

melli Forster, 1940

'*Zephyrus melli* spec. nov.' Forster, 1940: 871, Taf. 22, Figs 4, 5, Taf. 23, Figs 4, 5. Type locality (holotype): 'China, Kwangtung, Tsha-yuen-shan'.

Holotype ♂:

- ♂ with labels: printed, with handwritten insertion 'China | Tsha-jiu-san | | *16.* V*II.*[19]11, | Mell S. V.' (on yellow paper), printed 'China Kwantung | R. Mell' (on white paper) handwritten (Forster) on printed form 'Holo-Type ♂ | *Zephyrus*| *melli Forst.* | W. Forster München' (on pink paper).

Allotype ♀:

- ♀ with labels: printed, with handwritten insertion 'China Kwantung | *Tsha yuen shan* | *27. 6.* [19]*11* | R. Mell' (on white paper), handwritten (Forster) on printed form 'Allo-Type ♀ | *Zephyrus*| *melli Forst.* | W. Forster München' (on pink paper), handwritten (Mell) original field label 'Te 27 V [19]11 (recto) | <text in Chinese> (verso)' (on white faded paper, in pencil, folded).

Paratypes 6♂, 2♀:

- 2♂, ♀ with labels: printed, with handwritten insertion'China | Tsha-jiu-san | | <different dates>: VII. [19]11,| Mell S. V.' (on yellow paper), printed 'China Kwantung | R. Mell' (on white paper), original field labels (folded), handwritten (Forster) on printed form 'Para-Type ♂ (♀) | *Zephyrus*| *melli Forst.* | Dr. W. Forster München' (on pink paper);
- 2♂, ♀ with labels: printed 'China, Canton | Mell S. V.' (on white paper), printed 'China Kwantung | R. Mell' (on white paper), original field labels (folded), handwritten (Forster) on printed form 'Para-Type ♂ (♀) | *Zephyrus*| *melli Forst.* | Dr. W. Forster München' (on pink paper);
- ♂ with labels: printed, with handwritten insertion 'China Kwantung | *Tsha yuen shan* | *23.6.* [19]*17* | R. Mell' (on white paper), handwritten (Mell) original field label (folded), handwritten (Forster) on printed form 'Para-Type ♂ | *Zephyrus*| *melli Forst.* | Dr. W. Forster München' (on pink paper);
- ♂ with labels: printed, with handwritten insertion 'China Kwantung | *Lung tao shan* | *30.6.* [19]*17* | R. Mell' (on white paper), handwritten (Mell) original field label (folded), label, handwritten (Forster) on printed form 'Para-Type ♂ | *Zephyrus*| *melli Forst.* | Dr. W. Forster München' (on pink paper).

merisina Lorković, 1943

'*Everes argiades merisina* n.' Lorković, 1943: 450, Taf. 25, Fig. 11, Taf. 26, Figs 9, 10. Type locality: 'China, Kwang-tung, Gao-fung.'

Holotype ♂:

- ♂ with labels: printed, with handwritten insertion 'China | Tsha-jiu-san | | *22.* VII.[19]10, | Mell S. V.' (on yellow paper), handwritten (Forster <sic>) on printed form 'Holo-Type <corrected to Typ*us*> ♂ | *Everes argiades Pall.*| *merisina Lorkovic*' (on pink paper), handwritten (Mell) field label 'Te 22 VII (recto) | <typewritten> in (verso)' (on white paper, in pencil, folded) and a square piece of paper with handwritten '1a' in pencil (on white paper).

Allotype ♀

- ♀ with labels: printed, with handwritten insertion 'China | Tsha-jiu-san | | *21.* VII.[19]10,| Mell S. V.' (on yellow paper), handwritten (Forster <sic>) on printed form 'Allo-Type <corrected to Typ*us*> ♂ | *Everes argiades Pall.*| *merisina Lorkovic*' (on pink paper), handwritten (Mell) field label 'Te 21 VII 1a' in pencil (on white paper, folded).

Paratypes 15♂, ♀:

- 5♂ with labels: printed, with handwritten insertion 'China | Tsha-jiu-san | <*different dates*>: VII., VIII, IX [19]10,| Mell S. V.' (on yellow paper), printed 'China Kwantung | R. Mell' (on white paper), handwritten (Forster <sic>) on printed form 'Para-Typus ♂ | *Everes argiades Pall.*| *merisina Lorkovic*' (on pink paper);
- 2♂ with labels: printed 'China Kwantung | R. Mell' (on white paper), handwritten (Forster <sic>) on printed form 'Para-Typus ♂ | *Everes argiades Pall.*| *merisina Lorkovic*' (on pink paper);
- 5♂, ♀ with labels: printed, with handwritten insertion 'China Kwantung | *Tsha yuen shan* | <different dates> *8., 9.*, [19]10. | R. Mell' (on white paper), handwritten (Forster <sic>) on printed form 'Para-Typus ♂ (♀) | *Everes argiades Pall.*| *merisina Lorkovic*' (on pink paper);
- 2♂ with labels: printed, with handwritten insertion 'China Kwantung | *Man tai shan* | <different dates> *8., 9.*, [19]*15.* | R. Mell' (on white paper), handwritten (Forster <sic>) on printed form 'Para-Typus ♂ (♀) | *Everes argiades Pall.*| *merisina Lorkovic*' (on pink paper);
- ♂ with labels: printed, with handwritten insertion 'China Kwantung | *Lung tao shan* | *27.* [19]*17.* | R. Mell' (on white paper), handwritten (Forster <sic>) on printed form 'Para-Typus ♂ (♀) | *Everes argiades Pall.*| *merisina Lorkovic*' (on pink paper).

Some paratypes have also original field labels (on poor quality paper, folded).

mesopotamica Staudinger, 1892

'*Lycaena Poseidon* Led. var. *Mesopotamica* Stgr.' Staudinger, 1892a: 233. Type locality: 'Die von Manissadjian bei Malatia Anfangs Juli in Anzahl gefundenen Stücke...' — Junior subjective synonym of *Lycaena poseidon poseidon* Herrich-Schäffer, [1851] (Schurian *et al.*, 1992: 217).

Syntypes 6♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'Poseidon var. | Mesopotamica | Stgr.' (on white paper), circle of yellow paper, small date label '2/7' (on dirty green paper), printed 'Origin.' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), printed, with handwritten (Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *118* Figur *12*' (on white paper) — Hesselbarth *et al.* (1995: 726, Taf. 118, Fig. 12); Häuser & Eckweiler (1997: 90);
- 4♂ with circles of yellow paper, three of these with small date labels '2/7' '3/7' and '5/7' (on white faded yellow paper), one, dated '3/7', also has a handwritten (Staudinger) label 'Malatia' (on white paper faded brownish); all with printed labels 'Origin.' (on pink paper), two with printed 'Zool. Mus. | Berlin' (on pale yellow paper), two with new, handwritten in ball pencil 'mesopotamica' (on white paper);
- ♀ with labels: 'Malatia | [18]84 Man.[issadjian] (on yellow paper), small date label '11/7' (on dirty green paper), printed 'Origin.' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Wagener) 'Lycaena | mesopotamica | Stgr. 1892 | Malatia' (on white paper), printed, with handwritten (Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *118* Figur *49*' (on white paper) — Hesselbarth *et al.* (1995: 726, Taf. 118, Fig. 49 as 'Original' '*Dama* Stgr.'); cf. Häuser & Eckweiler (1997: 90);
- ♀ with circle of yellow paper, small date label '2/7' and printed label 'Origin.' (on pink paper);
- ♂ with labels: handwritten (Püngeler) 'Mesopot.[amia] (recto) | 'mesopotamica | ♂ | vom Stgr 4.99 (verso)' (on white paper,

recto in printed box), handwritten (Püngeler) on printed form 'Cotype <underlined> | *v. mesopotamica Stgr.* | ♀ | *vom Autor.* | *Püngeler*' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Poseidon H.S. | v. Mesopotamica Stgr.' (on white paper, in printed box).

minima Staudinger, 1901

'*Cigaritis* B. *Cilissa* Ld. v. *Minima* Stgr.' Staudinger, 1901: 76. Type locality: 'Taur.[us] s.[eptentrionalis] (Hadjin).' — Junior subjective synonym of *Cigaritis cilissa* Lederer, 1861 (Hesselbarth *et al.,* 1995: 455).

Syntypes 3♂, ♀:

- ♂ with handwritten label 'Hadjin | [18]88 K. O.' (on yellowish paper) and small handwritten date label '6/7';
- 2♂, ♀ with same small (date) labels '5/7', '6/7' and '12/7'.

The specimens are provided now with a printed label '*cilissa minima* | Staudinger, 1901 | SYNTYPUS | Y. Nekrutenko det. 1998' (on yellow paper).

miris Staudinger, 1881

'*Lyc.*[*aena*] *Miris* Stdgr. n. sp.' Staudinger, 1881: 263. Type locality: 'Diese neue Art wurde zuerst von Christoph bei Schahrud (Nord-Persien am Fuße des Gebirges) Mitte Mai gefunden; dann fand sie Haberhauer in einigen Stücken bei Saisan, später ein Stück bei Lepsa und 1880 in einigen 20 Exemplaren bei Margelan (Central Turkestan)'.

Syntypes 12♂, 4♀:

- ♂ with labels: handwritten 'Schahrud | Chr.[istoph]' (on yellow paper), printed 'Origin.' (on pink paper);
- 3♂, ♀ with circles of yellow locality label paper and printed label 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Saisan | Hbhr. [Haberhauer]' (on brown paper), printed 'Origin.' (on pink paper);
- 2♂ with circles of brown locality label paper and printed label 'Origin.' (on pink paper);

- ♂ with labels: handwritten 'Lepsa | Hbhr. [Haberhauer]' (on brown paper), printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Margelan | Hbhr. [Haberhauer]' (on brown paper), printed 'Origin.' (on pink paper);
- 3♂, 3♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper); some specimens have handwritten date labels, not always clearly legible.

mirza Staudinger, 1874

'*Lycaena Mirza* n. sp.' Staudinger, 1874: 90. Type locality: 'Diese neue Art wurde gleichfalls von Herrn Christoph entdeckt, der aber nur wenig Stücke davon fing. Ich beschreibe sie nach sechs Exemplaren meiner Sammlung, von denen 4 (3 ♂♂ und 1 ♀) vom 28. Mai bis 1. Jumi bei Tasch, 2 ♂♂ am 16. Juni bei Schakuh, also auch im nördlichen Persien, gefangen wurden.' — Junior subjective synonym of *Lycaena sieversi* Christoph, 1873 (Staudinger, 1901: 80).

Syntypes 4♂, ♀:

- 4♂, ♀ syntypes of *sieversii* Christoph, 1873.

The specimens are placed under a handwritten drawer label 'Sieversii | Chr. | Mirza Stgr.' (on white paper, in printed box); each provided now with a printed label '*sieversii* Christoph, 1873 | *mirza* Staudinger, 1874 | SYNTYPUS | Y. Nekrutenko det. 1.12.1998' (on yellow paper) — see *sieversii* below.

mithridates Staudinger, 1878

'*Lyc.*[*aena*] *Mithridates* Stgr. n. sp.' Staudinger, 1878: 247. Type locality: 'Das eine Stück ist am 17 Juli, wahrscheinlich von mir im Kerasdere gefangen, da aber am selben Tage Emil nach der Jenikeui-Hochebene, Zach und Johann nach dem Kyschlatschyk-Wege waren, so bin ich meiner Sache nicht sicher'.

Syntypes 6♂, ♀:

- ♂, pinned underside up, with labels: handwritten (Wagener) 'Lycaena | mithridates | Stgr. 1878' (on white paper), 'Amasia m.[ihi]' (on yellow paper), printed 'Origin.' (on pink paper) and 'Zool. Mus. | Berlin' (on pale yellow paper), printed, with handwritten (Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *116* Figur *55*' (on white paper) — Häuser & Eckweiler (1997: 90);

- ♀ with labels: 'Amasia | Joh.[ann]' (on yellow paper), printed 'Origin.' (on pink paper);
- ♂ with circle of yellow locality label paper and printed 'Origin.' (on pink paper);
- ♂ with labels: 'Amasia | Joh.[ann]' (on yellow paper), printed 'Origin.' (on pink paper);
- 3♂ with circles of yellow locality label paper and printed 'Origin.' (on pink paper).

monticola Staudinger, 1901

'*Lycaena* F. *Alcon* F. v. *Monticola* Stgr.' Staudinger, 1901: 90. Type locality: 'Cauc.[asus]; Helv.[etia]; Pont.[us]; ? Lyd.[ia] mont.[es]'.

Syntypes 4♂, 2♀:

- ♂ with labels: handwritten 'Achalzich | Habhr. [Haberhauer] [18]82' (on green paper) printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten 'Lycaena alcon | monticola' (on white paper) and new printed 'Typus' (recto red, verso white);
- ♀ with circle of green locality label paper, handwritten 'Lycaena alcon | monticola | Achalzich Hbhr. | [18]82' (on white paper) and new printed 'Typus' (recto red, verso white);
- ♂ with labels: handwritten 'Macugnaga | m.[ihi]' (on brownish paper) and new printed 'Typus' (recto red, verso white);
- ♀ with circle of brownish locality label paper and new printed 'Typus' (recto red, verso white);
- ♂ (abdomen missing, pinned here to in a piece of packing paper wrapper) with labels: handwritten 'Valesia | Ag.[?]' (on yellowish paper) and new printed 'Typus' (recto red, verso white);
- ♂ (abdomen missing) with labels: handwritten 'Armenia | Radde' (on yellow paper), handwritten 'Istissu' (on white paper faded yellow-brown, in pencil) and new printed 'Typus' (recto red, verso white);

Likewise most of the Staudinger species-group taxa becoming available after his death in 1900 (i. e. in Staudinger, 1901), the type specimens were not designated with characteristic 'Origin.' labels.

As may be seen from the original description, the type locality statement was pretty broad, so that all forementioned specimens are labelled such as to fit Staudinger's meaning of the '*terra typica*' to constitute a syntype series. The author of the syntype designation with 'Typus' labels is unknown (cf. Hesselbarth *et al.,* 1995: 576).

The specimens are placed under a handwritten drawer label 'v. Monticola | Stgr.'.

myrrha Herrich-Schäffer, [1851]

'[*Lycaena*] *Myrrha*' Herrich-Schäffer, [1851] **1**(49): Tab. 106, Figs 508–511; [1852] **6**(55): 26. Type locality: 'Aus Kleinasien' (cf. Staudinger, 1878: 242).

?-Syntype:

- ♂ with printed labels: 'Origin. *?* | *?*' (on pink paper, with handwritten Staudinger insertions), 'Coll Led.' (on white paper), 'Zool. Mus. | Berlin' (on pale yellow paper), with handwritten insertion 'ZSM | Negativ | No. *107/108*' (on white paper).

One of 5 (4♂, ♀) specimens of the collection was designated by Staudinger (1878: 241–242) as an apparent syntype: 'Dieser ist in Herrich-Schäffer's Figur beim ♂ gar nicht angegeben und auch bei dem alten Lederer'schen Stück (vielleicht dem Original ?) nur sehr matt erkennbar. Sonst ist die Figur gut. Die ächte *Myrrha* ist nur bei Amasia und Tokat (Kindermann) gefunden.' (see also Hesselbarth *et al.*, 1995: 666).

myrrhina Staudinger, 1901

'*Lycaena* F. *Myrrha* HS. v. *Myrrhina* Stgr.' Staudinger, 1901: 85. Type locality: 'Pont.[us] or.[ientalis] Gümüschane)'.

Syntypes 4♂:

- ♂ with labels: handwritten (Staudinger) 'v. Myrrhina | Stgr.' (on white paper), 'Gümüschchane | Pont [18]94 Sint.[enis]' (on yellow paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper) and 'Origin.' (on pink paper);
- ♂ with labels: circle of yellow locality label paper, handwritten (O. Bang-Haas?) 'Gümüschchane ♂ | Pont 94 Sint.[enis]', 'Lÿcaena myrrha H. S. | var. mÿrrhina Stgr.' (the first was added

subsequently as an extension of the circle reference), printed Bang-Haas label 'Type' (on red paper), a square piece of purple-violet paper, handwritten (de Lesse) 'de Lesse | 1946' (on white paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Wagener) 'myrrhina | Berlin', printed, with handwritten (Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *111* Figur *29*' (on white paper) — Hesselbarth *et al.* (1995, Taf. 111, Fig. 29);

- ♂ with labels: handwritten 'Egin | [18]84 Man.[issadjian]' (on yellow paper), small date label '4/7', printed 'Zool. Mus. | Berlin' (on pale yellow paper);
- ♂ with labels: circle of yellow locality label paper, handwritten (unknown hand) 'myrrha | myrrhina Stgr. | Egin, Türkei' (on white paper); printed 'Origin.' (on pink paper), printed, with handwritten insertion 'ZSM | Negativ | No. *105/106*' (on white paper), printed 'Zool. Mus. | Berlin' (on pale-yellow paper), printed, with handwritten (Wagener) insertions 'Abgebildet in Hesselbarth | van Oorschot & Wagener: | Tagfalter der Türkei. | Tafel *111* Figur *30*' (on white paper) — cf. Hesselbarth *et al.* (1995: Taf. 111, Fig. 34).

myrtale Klug, 1834

'*Lycaena Myrtale*' Klug, 1834: Decas Quarta: Signature *l*(i), Tab. 40, Figs 15, 16. Type locality: 'Habitat in Syria'.

Syntypes 3♂:

- ♂ with labels: handwritten 'Myrtale | Kl.[ug] Symb.[olae] t.[abula] 40 f.[igurae] 15, 16 | Syria Ehrbg. [Ehrenberg]' (recto yellow, in printed box, verso white) and printed '4341' (on white paper);
- 2♂ without any label.

Catalogus Generalis: 4341 — see Appendix.

The specimens are provided now with a printed label '*myrtale* Klug, 1834 | SYNTYPUS | A. Olivier & Y. Nekrutenko det. 30.11.1998' (on yellow paper).

nahizerica Eckweiler, 1978

'*Aricia teberdina nahizerica* ssp. n.' Eckweiler, 1978: 115, Abb. 1–4. Type locality: 'NO Türkei: Prov. Erzurum: Ispir: vic. Nahizer.'

Paratypes ♂, 4♀:

- ♂, 4♀ with printed labels: 'Türkei/Erzurum | Ispir/Nahizer | 1700-1900 m | 4.8.-8.8.[19]77 | leg. ECKWEILER' (on white paper), 'Paratypus ♂ (♀) | Aricia teberdina ssp. | nahizerica | des. ECKWEILER 1978' (on deep red paper).

nogelii Herrich-Schäffer, [1851]

'[*Thecla*] *Nogelii*' Herrich-Schäffer, [1851] **1**(51): Tab. 110, Figs 529–532; [1852] **6**(55): 33–34. Type locality: 'Aus Amasia'.

Types: not found (for lectotype designation see van Oorschot & Wagener, 2000: 97–98).

oberthueri Staudinger, 1887

'*Thecla Oberthüri* Stgr.' Staudinger, 1887b: 138, pl. 6, fig. 4, a, b. Type locality: 'Dörries fing sie zuerst am Ussuri, später zog er sie auf Askold oder am Bykin; im vorigen Jahr fand er sie auch am Suifun...'

Syntypes:

- ♂ with labels: handwritten (Staudinger) 'Butleri Waterh.? <crossed out, corrected:> Fenton | Obertüri | Stgr.' (on white paper), handwritten 'Askold | [18]83 Dörr.[ies]' (on bluish-violet paper), printed 'Origin.' (on pink paper);
- 5♀ with same printed labels 'Origin.', two of these with handwritten locality labels 'Suifun | [18]85 Dörr.[ies]' and 'Ussuri | Dörr.[ies] [18]82' (both on bluish-violet paper), two with circles of bluish-violet paper, one has a small handwritten label '13'.

oberthueri Staudinger, 1901

'*Lycaena* F. *Orbitulus* Prun. subv.[arietas] *Oberthüri* Stgr.' Staudinger, 1901: 81. Type locality: Pyr.[enees] c.[entrales]. — Junior primary homonym of *Lycaena elvira oberthueri* Grumm-Grshimailo, 1887; replacement name: *magnaglandon* Verity, 1949: 134 (Kudrna, 1983: 30).

Syntypes 4♂, ♀:

- 2♂ with labels: printed 'Hautes Pyrénées | Cauterets | R. Oberthür | Juillet 1881' (on white paper, in box), printed 'Origin.' (on pink paper) and a circle of blue paper; one ♂ with handwritten (Staudinger) 'subv. /Oberthüri | Stgr.' (on white paper);
- ♂ with labels: handwritten 'Pyrenais <sic> | Morel' and printed 'Origin.' (on pink paper);
- ♂, ♀ with circles of blue locality label paper and printed 'Origin.' (on pink paper).

obscurata Staudinger, 1892

'*Lyc.*[*aena*] *Euphemus* Hb. var. *Obscurata* Stgr.' Staudinger, 1892d: 320. Type locality: 'Es liegen mir 4♂♂ und 5♀♀ vom Kentei vor...'

Syntypes 3♂, 5♀:

- ♂ with labels: handwritten (Staudinger) 'v. Obscurata' (on white paper), handwritten 'Kentei | [18]89 Dörr.[ies]' (on green paper) and printed 'Origin.' (on pink paper);
- ♂, 2♀ with circles of green locality label paper and printed label 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Ala Tau | Hbhr. [Haberhauer]' (on brown paper) and printed 'Origin.' (on pink paper);
- 3♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper).

obscurata Staudinger, 1901

'*Cigaritis* B. *Acamas* Klug v. *Obscurata* Stgr.' Staudinger, 1901: 76. Type locality: 'Taur.[us] s.[eptentrionalis] (Hadjin).' — Junior subjective synonym of *Lycaena acamas acamas* Klug, 1834.

Syntypes 3♂, 2♀:

- ♂ with labels: handwritten 'Hadjin | [18]88 K. O.[?]' (on yellow paper), small handwritten '20/6' and printed 'Origin.' (on pink paper);

- 2♂, 2♀ with same printed labels 'Origin.', with small handwritten (date) labels and with circles of yellow locality label paper.

The specimens are placed under a handwritten (Staudinger) drawer label 'v. Obscurata | Stgr.' (on white paper).

ochimus Herrich-Schäffer, [1851]

'[*Polyommatus*] *Ochimus*' Herrich-Schäffer, [1851] **1**(49): Tab. 109, Figs 523–526; [1852] **6**(55): 31–32. Type locality: 'Aus Kleinasien'.

Types: not found.

olympica Lederer, 1852

'*Lycaena Corydon Var. Olympica*' Lederer, 1852: 36, Nachtrag: 53. Type locality: 'vom Olymp bei Brussa'.

Lectotype ♂:

- ♂ with labels: handwritten 'Brussa' (on white paper), printed 'Coll. Led.' (on white paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Schurian) on printed lined form '*Polyommatus* | *(Lysandra)* | *ossmar olympica* | *Lederer 1852* | *det. Schurian* 1*988*' (on white paper), handwritten (Schurian) on printed form 'Gen. Präparat | Nr. *216*/1*985*' (on white paper), handwritten (Schurian) on printed form '*Lysandra ossmar* | *ssp. olympica Led. stat. nov.* | det. Schurian 1*985*', handwritten (Schurian) '*Lectotypus* ♂ <written over printed 'Paratypus'> | *Lycaena* | *ossmar olympica* | *Lederer 1852* | des. Schurian, 1*988*' (on red paper, in box) — Schurian (1988: 136).

omphale Klug, 1834

'*Lycaena Omphale*' Klug, 1834: Decas Quarta: Signature *k*(iv), Tab. 40, Figs 12–14. Type locality: 'Habitat in Syria.' — Junior subjective synonym of *Lycaena thersamon* Esper, [1784].

Types: not found; *Catalogus Generalis*: 4554 — see Appendix; only a drawer label 'Var. | Omphale | Klug Symb. phys. | Syria | Ehrbg' (recto yellow, in dotted line box, verso white) was found.

orbitulinus Staudinger, 1892

'*Lyc.*[*aena*] *Orbitulus* Esp. var. (Orbitulinus) Stgr.' Staudinger, 1892d: 318. Type locality: '...im Kentei...'

Syntypes 3♂, ♀:

- ♂ with labels: handwritten (Staudinger) 'var. Orbitulinus | Stgr.' (on white paper), handwritten 'Kentei | [18]89 Dörr.[ies]' (on green paper) and printed 'Origin.' (on pink paper);
- 2♂, ♀ with circles of green locality label paper; one male specimen has also a handwritten label 'Kentei' (on white, faded yellow, paper).

orientalis Staudinger, 1881

'*Polyomm.*[*atus*] *Dorilis* Hufn. var. *orientalis* Stgr.' Staudinger, 1881: 281. Type locality: '...aus dem Caucasus und Kleinasien... Ala Tau... Brussa...' — Junior subjective synonym of *Papilio tityrus tityrus* Poda, 1761 (Hesselbarth *et al.*, 1995: 475).

Lectotype ♂:

- ♂ with labels: handwritten 'Ala Tau | Hbhr. [Haberhauer]' (on brown paper), printed 'Origin.' (on pink paper), circle of blue paper, handwritten (Nekrutenko) on printed form 'LECTOTYPUS ♂ | *orientalis Stgr.* | Y. Nekrutenko design.' (on yellow paper, in box) — Nekrutenko *in* Hesselbarth *et al.* (1995: 475).

Paralectotypes 3♂, 3♀:

- ♀ with a circle of brown locality label paper identical to that of the lectotype and printed label 'Origin.', handwritten (Nekrutenko) on printed form 'PARALECTOTYPUS ♀ | *orientalis Stgr.* | Y. Nekrutenko design.' (on yellow paper, in box);
- ♂ with labels: handwritten 'Amasia | Sch.' (on yellow paper), handwritten '10/5' and printed 'Origin.' (on pink paper);
- ♂, ♀ with labels: handwritten 'Brussa' (on white paper), printed 'Coll. Led.' (on white paper) and printed 'Origin.' (on pink paper);
- ♂, ♀ with labels: handwritten 'Caucasus' (on white paper), printed 'Coll. Led.' (on white paper) and printed 'Origin.' (on pink paper).

orientalis Staudinger, 1901

'*Lycaena* F. *Amandus* Schn. v. *Orientalis* Stgr.' Staudinger, 1901: 85. Type locality: 'Pont.[us]; Arm.[enia]; Hyrc.[ania]; Tarb.[agatai]; Ala Tau'; restricted by lectotype designation: 'Amasia' — Junior subjective synonym of *Papilio amandus amandus* Schneider, 1792.

Lectotype ♂:

- ♂ (head and abdomen missing), with labels: handwritten 'Amasia | m.[ihi?]' (on yellow paper), handwritten 'orientalis | Stgr.' (on white paper, in pencil), handwritten (Bernardi) on printed form '*L. amandus* | *orientalis Stgr.* | *lectotype* ♂ Bernardi dét. | 1964 | cf. *Alexanor, III: 273* | *1964*' (on white paper) and combined printed/handwritten designation label '*LECTO*TYPE' (on red paper) — Bernardi (1964: 273).

Paralectotypes 12(15?)♂, 10(9?)♀:

- ♀ with handwritten labels: 'Amasia | Joh.[annes]' (on yellow paper), small date label '10/6';
- ♀ with circle of yellow locality label paper and small date label '4/6';
- ♂ with labels: handwritten 'Taurus | Hbhr. [Haberhauer]' (on yellow paper), handwritten (Bernardi) 'v. orientalis | Stgr.' (on white paper, in pencil), printed 'Paratypus' (on red paper, in box);
- ♂ with labels: handwritten 'Hadjin | [18]88 K. O.' (on yellow paper), small date label '28/5', printed 'Paratypus' (on red paper, in box);
- ♀ with handwritten labels: 'Eibes | [18]89 Man.[issadjian].' (on yellow paper), small date label '6/5';
- ♂, ♀ with handwritten labels: 'Tekke | [18]94 Wild.[?].' (on yellow paper);
- ♂ with circle of yellow locality label paper, small date label '11/6' and printed 'Paratypus' (on red paper, in box);
- ♂ with circle of yellow locality label paper;
- ♂ with handwritten labels: 'Achalzich | Hbhr. [Haberhauer] [18]82' (on green paper) and small date label '3/8';

- ♂ with circle of green locality label paper, small date label '2/7';
- 2♂ with labels: handwritten 'Caucasus' (on white paper), circle of green locality label paper (one ♂ only), printed 'Coll. Led.' (on white paper) and printed 'Paratypus' (on red paper, in box);
- ♂ with handwritten label: 'Schakuh | Chr.[istoph]' (on yellow paper) and small date label '7/6' (on brown paper);
- 2♀ with circle of yellow locality label paper;
- ♀ with handwritten label: 'Astrabad | Hbhr. [Haberhauer]' (on yellow paper);
- ♂ with handwritten label 'Tarbagatai | Hbhr. [Haberhauer]' (on brown paper);
- ♀ with circle of brown locality label paper;
- ♂ with handwritten label 'Ala Tau | Hbhr. [Haberhauer]' (on brown paper);
- ♀ with circle of brown locality label paper;
- ?-♂ with handwritten label 'Margelan | Hbhr. [Haberhauer]' (on brown paper);
- ?-♂ with handwritten labels: 'Margelan | Maur.[er] [18]84' (on brown paper), date label '17/5' 'Scheichm[?]' (folded);
- ?-♂ with handwritten label 'Namangan | Hbh. [Haberhauer] [18]84' (on brown paper);
- ?-♀ with circle of brown locality label paper and handwritten date label '28/5'.

Likewise most of the Staudinger species-group taxa becoming available after his death in 1900 (i. e. in Staudinger, 1901), the type specimens were not designated with characteristic 'Origin.' labels. As may be seen from the original description, the type locality statement was pretty broad, so that all forementioned specimens are labelled such as to fit Staudinger's meaning of the '*terra typica*' to constitute a syntype series. Since 'Grâce à l'amabilité du Dr Hannemann j'ai sous les yeux certains des exemplaires de Staudinger qui représentent donc, en langage moderne, les syntypes d'orientalis', Bernardi (1964: 273) received on loan only five

specimens (by selection of Hannemann), one of these "Je choisis comme lectotype ♂ un exemplaire étiqueté "Amasia", the rest were labelled by him (or by Hannemann on return of the loan?) with printed labels 'Paratypus'. In fact, the entire series mentioned above represents the type series (syntypes and, subsequently, paralectotypes).

ornata Staudinger, 1892

'*Lycaena Orion* Pall. und var. *Ornata* Stgr.' Staudinger, 1892b: 159. Type locality: 'Maack fand sie am Amur-Ufer, Radde am Onon und im Bur.[eja] G.[ebirge], Christoph bei Radd.[efka] and Wlad.[iwostok], Dörries auf Ask.[old], am Sutschan und am Bik.[in], Graeser bei Pokr.[ofka] häufig, bei Wlad.[iwostok] nur an einer stelle... ...alle mir vorliegenden Amur-Stücke der ersten Generation...': replacement name: *Scolitantides orion athenae* Hemming, 1934: 98 (the replacement is not justified since it is a *senior* primary homonym of *Lycaena astrarche* ab. *ornata* Staudinger, 1892 below; for the dates unknown to Hemming see *Reference* section).

Syntypes 5♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'v. Ornata | Stgr. | typisch' (on white paper), 'Raddefskaja | Chr.[istoph]' (on violet paper), small handwritten date label '18/5' and printed 'Origin.' (on pink paper);
- ♂, ♀ with circles of violet locality label paper and printed 'Origin.' (on pink paper);
- ♂, with labels: handwritten 'Wladiwostock | Chr.[istoph]' and printed 'Origin.' (on pink paper);
- ♂, ♀ with labels: handwritten 'Askold | Dörr.[ies]' (♂ with date '[18]83' and printed 'Origin.') (on pink paper);
- ♂ with labels: handwritten 'Bykin | 18[87] Dörr.[ies]' and printed 'Origin.' (on pink paper).

ornata Staudinger, 1892

'*Lyc.*[*aena*] *Astrarche* Bergstr. ab. *Ornata* Stgr.' Staudinger, 1892c: 280. Type locality: '...von Tunis... Ganz ähnliche (gleiche) Stücke fing ich in Anzahl auf der Insel Sardinien, sowie einzeln bei Chiclana (Cadiz), auch besitze ich ein ♂ von Teneriffa und ein ♀ von Corsica' — Infrasubspecific (cf. Hemming, 1934: 98).

Syntypes 9♂, ♀:

- ♂ with labels: handwritten (Staudinger) 'v. (ab.) | Ornata Stgr.' (on white paper), 'Sardinia | m.[ihi?]' (on pale pink paper) and printed 'Origin.' (on pink paper);
- 5♂, with circles of pale pink locality label paper and printed label 'Origin.' (on pink paper);
- ♀ with labels: handwritten 'Corsica' (on white paper), printed 'Coll. Led.' (on white paper) and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Chiclana | m.[ihi?] [18]80' (on green paper) and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Tunis | [18]91 Vaulog.' (on white paper) and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Teneriffa | Boecker' (on white paper) and printed 'Origin.' (on pink paper).

osiris O. Bang-Haas, 1927

'*Lycaena osiris* O. B.-Haas, spec. nov.' Bang-Haas, O., 1927: 52, Taf. 7, Figs 26, 27. Type locality: 'Armenien; Kagymann (recte: Kagyzman) mont., Dorf Tschangla unteres Ufer des Araratflusses. Gebirgswiesen 2300–2500 m.' — Junior primary homonym of *Lycaena osiris* Hopffer, 1855; replacement name: *Aricia kagizmanensis* Koçak, 1980a: 142; junior subjective synonym of *Papilio eumedon eumedon* Esper, [1780] (Hesselbarth *et al.*, 1995: 625).

Lectotype ♂:

- ♂ with labels: handwritten (O. Bang-Haas) 'Lyc.[aena] osiris | O B Haas' (on white paper), printed 'Kagyzman | 3000m Juli | Russ. Armen.' (on white paper), printed, with handwritten insertions 'Horae Macrolep. | Vol. I abgebildet | t. *7*, f. *26* | beschrieb. p. *52*' (on white paper), printed 'Type | O. Bang-Haas' (on pink paper), printed 'Zool. Mus. | Berlin' (on yellow paper), handwritten (Nekrutenko) on printed form 'LECTOTYPUS ♂ | *osiris O. Bang-Haas* | *1927.* | Y. Nekrutenko design.' (on yellow paper) — Nekrutenko *in* Hesselbarth *et al.* (1995: 625).

Paralectotype ♀:

- ♀ (pinned underside up), with labels: printed 'Kagyzman | 3000m Juli | Russ. Armen.' (on white paper), printed 'Type | O. Bang-Haas' (on pink paper), printed 'Zool. Mus. | Berlin' (on yellow paper), handwritten (Nekrutenko) on printed form 'PARALECTOTYPUS ♀ | *osiris O. Bang-Haas* | *1927.* | Y. Nekrutenko design.' (on yellow paper).

ossmar Gerhard, [1851]

'*Lycaena Corydon Hbr.* [Hübner] *Var. Ossmar. Bischoff*' Gerhard, [1851]: 17, Pl. 31, Fig. 4 a, b, c. Type locality: 'Türkei.' ... '...empfing ich durch Herrn Bischoff, der dieselbe in der Türkei fing.'

Neotype ♂:

- ♂ with labels: [handwritten 'Amasia' (on yellow paper)] – indicated by Schurian (1988: 135) but not found, handwritten 'corydonius | H. S.' (on white paper, in pencil), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Schurian) on printed lined form '*Polyommatus* | *(Lysandra)* | *ossmar* | *GERHARD 1851* | *det. Schurian* 1988' (on white paper), handwritten (Schurian) on printed form 'Gen. Präparat | Nr. *214*/1985 | *Schurian*', handwritten (Schurian) on printed form 'Neotypus ♂ | *Lysandra ossmar* | *GERHARD (1851)* | *teste* SCHURIAN 1984' (on red paper) and '*Neotypus* ♂ <written over printed 'Paratypus'> | *Lycaena corydon* | *ossmar* | *GERHARD 1851* | det. Schurian, 1988' (on red paper, in box) — Schurian (1988: 135, Taf. 1, 2, Fig. 5).

palandoekis Schurian & Häuser, 1981

'*Meleageria daphnis palandökis* n. subsp.' Schurian & Häuser, 1981: 105. Type locality (holotype): 'Anatolia/Erzurum Palandöken dagh 2200 m vic. Palandöken, 2 km südlich'. — Junior subjective synonym of *Lycaena meleager versicolor* Heyne, [1895] (Hesselbarth *et al.*, 1995: 687).

Paratypes 2♂, ♀:

- 2♂, ♀ with printed labels: 'ANATOLIA/Erzurum | Palandöken dagh/2200 m | vic. Palandöken/2 km südl. | 5.VIII u. 13. - 15.vIII <sic> [19]77 | leg. Schurian' (on white paper) and

'Paratypus | Meleageria daphnis | palandoekis n. ssp. | Schurian/Häuser 1981' (on white paper, in red box).

panaegides Staudinger, 1886

'*Lyc.*[*aena*] *Panaegides* Stgr. (Panagaea var.?)' Staudinger, 1886: 206. Type locality: 'im Juli mit typischen Cytis zusammen in den Gebirgen bei Samarkand gefangen haben.'

Syntypes 6♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'Cytis v. Panaegides | Stgr. | <in different ink> Alaica Stgr. | synonym.' (on white paper), 'Prov. Samarkand | Hbhr. [Haberhauer] [18]81' (on brown paper) and printed 'Origin.' (on pink paper);
- 5♂, 2♀ with printed label 'Origin.' (on pink paper) and circles of brown locality label paper; one of the male specimens also has a small handwritten date label '6/7' (on white paper).

panagaea Herrich-Schäffer, [1851]

'[*Lycaena*] *Panagaea*' Herrich-Schäffer, [1851] **1**(47): Tab. 103, Figs 490–493; '*Panagaea* Kad. ... (früher *Endymion* Kind.)' [1852] **6**(55): 30. Type locality: 'Beide Geschlechter aus Kleinasien, von Herr Kindermann'. — Junior subjective synonym of *Lycaena endymion* Gerhard, [1851]. The priority of Gerhard's name over that of Herrich-Schäffer's [1851] is established here after Koçak, 1980c: 17 (cf. ICZN Art. 21.3.1, 21.3.2).

Types: not found.

parnassia Staudinger, 1870

'*Lycaena Semiargus* Rott. (Acis S. V.) v. *Parnassia*' Staudinger, 1870b: 55. Type locality: 'Nur auf dem Parnass... gefangen und zwar in grosser Anzahl.'

Syntypes 7♂, 6♀:

- ♂ with labels: handwritten 'Parnass | Kr.[üper]' (on yellow paper), printed, with handwritten insertion 'Parnass | *20/4* [18]*66*' (on white paper), printed 'Origin.' (on pink paper);
- 5♂, 5♀ with circles of yellow locality label paper and printed label 'Origin.' (on pink paper);

- ♂, ♀ with labels: printed, with handwritten (Püngeler) insertion 'Graecia | *sept.*[entrionalis] *mont.*[es] (recto) | parnassia ♂ (♀) | vom Stgr. | *Püngeler* (verso)' (on white paper) and handwritten (Püngeler) on printed form 'Cotype <underlined> | *v. parnassia Stgr.* ♂ (♀) | *Püngeler*' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Semiargus Rott. | v. Parnassia Stgr.' (on white paper, in printed box).

persephatta Alphéraky, 1881

'*Lycaena persephatta* Alph. nov. sp.' Alphéraky, 1881: 395, Tab. 14, Fig. 11. Type locality: 'L'espèce assez râre, volait en Juin le long du Kounguesse entre 4 et 6000 pieds.'

Syntypes ♂, 3♀:

- ♂ with labels: handwritten 'Tian Schan | Alph.[éraky]' (on brown paper), handwritten (Alphéraky) date label '5/VI [1879]' (on white paper) and printed 'Origin.' (on pink paper);
- 3♀ with circles of brown locality label paper, handwritten (Alphéraky) date labels '3/VI [1879]' and '7/VI [1879]' (on white paper) and printed labels 'Origin.' (on pink paper); one female specimen has a handwritten (Alphéraky) label '3 VI 1879. | Tianchan. | Persephatta' (on white paper).

Under a handwritten drawer label 'Persephatta | Stgr.' (on white paper, in box) there are placed 7 more specimens designated with Staudinger's printed labels 'Origin.' (on pink paper): 2♂, 4♀ from 'Margelan | Hbhr. [Haberhauer]' and a ♀ from 'Ala Tau | Hbhr. [Haberhauer]'. Along with forementioned specimens, they constitute the type series of a taxon Staudinger intended to describe, but he abandoned this intention after Alphéraky's publication (cf. Staudinger, 1901: 89). The specimens collected by Alphéraky during his 1879 trip to 'district de Kouldjà et des montagnes environnantes' (inclusive Tien-Shien Mts.) and which he sent to Staudinger undoubtedly are an integral part of his type series, and hence are provided now with a printed label '*persephatta* | Alphéraky, 1881 | SYNTYPUS | Y. Nekrutenko det. 11.11.1998' (on yellow paper).

persica Bienert, [1869]

'*P.*[*olyommatus*] *Thersamon var. persica m.*' Bienert, [1869]: 28. Type locality: 'In subalpiner Region des Gebirges im NW. von Meschet…'

Types: not found (see also Hesselbarth *et al.*, 1995: 485).

persica Bienert, [1869]

'*Lyc.*[*aena*] *Icarus var. persica m.*' Bienert, [1869]: 29. Type locality: 'Mit dem Stammform bei Nischapur, Ssäbsewar, Chanlung und Meschet…' — Junior secondary homonym of *Lycaena thersamon persica* Bienert, [1869]; replacement name: *Polyommatus icarus bienerti* Bálint, 1992: 410, 415. Junior subjective synonym of *Papilio icarus* Rottemburg, 1775.

Lectotype ♂:

- ♂ with labels: handwritten 'Mesch.[et] 170' (on white paper), a circle of yellow paper, printed 'Origin.' (on pink paper), handwritten (Nekrutenko) on printed form 'LECTOTYPUS ♂ | *persica Bien.* | Y. Nekrutenko design.' (on yellow paper) — Nekrutenko *in* Hesselbarth *et al.* (1995: 676).

Paralectotype ♂:

- ♂ with labels: handwritten 'Persia | Bnt. [Bienert]' (on yellow paper), printed 'Origin.' (on pink paper), handwritten (Nekrutenko) on printed form 'PARALECTOTYPUS ♂ | *persica Bien.* | Y. Nekrutenko design.' (on yellow paper) — Nekrutenko *in* Hesselbarth *et al.* (1995: 676).

pfeifferi Brandt, 1938

'*Lycaena Pfeifferi sp. n.*' Brandt, 1938: 671, Taf. 4, Figs 1–3. Type locality: Iran. 'Die Typenserie von Barm i Firus (3750 m), Juli doch kommt diese Art auch im Elbursgebirge vor, so z. B. im Juni auf den Bergen um Nissa'.

Paratypes ♂, ♀:

- ♂, ♀ with labels: printed 'IRAN FARS, Straße | Ardekan - Talochsroe | Comé m 1937 | coll. Brandt' (on pale yellow paper), printed '62.' (on white faded paper), a small square piece of pale pink paper, printed 'Paratypus' (on red paper) and handwritten 'Lycaena | pfeifferi B.[randt]' (on white paper) — cf. Häuser & Eckweiler (1997: 94).

pharaonis Staudinger, 1895

'*Lycaena Pharaonis* Stgr. n. sp.' Staudinger, 1895a: 243. Type locality: '...beschriebe ich sie hier nach 5 ♂♂ und einem ♀ meiner sammlung. Das eine ♂ wurde am 5. December bei Cairo, ein anderes am 18. Januar bei Ipsambul (?) in Aegypten gefangen, 3 Stücke habe ich, als aus Nubien stammend, erhalten.' — Junior subjective synonym of *Lycaena eleusis* Demaison, 1888 and *Lycaena podorina* Mabille, 1890 (Staudinger, 1901: 77).

Syntypes 4♂, ♀:

- ♂ with labels: handwritten (Staudinger) 'Eleusis Demaison | Podorina Mab. | Pharaonis Stgr.' (on yellowish paper), handwritten 'Cairo', handwritten 'Ipsamb. | 18/I [18]80' (on white paper) and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Cairo | 5/12 [18]79 | Eibek.' (on white paper), circle of white locality label paper and printed 'Origin.' (on pink paper);
- 2♂, ♀ with circles of white locality label paper and printed 'Origin.' (on pink paper), one male specimen has a handwritten label 'Nubien' (on white paper, in pencil).

phellodendri Staudinger, 1892

Nomen nudum. '*Thecla Herzi* Fxsn. ... *Phellodendri*...' Staudinger, 1892b: 150. Type locality: 'Christoph fing diese Art anfang Juli bei Wlad.[iwostok] auf *Phellodendron amurense* und hatte ich sie bereits als *Phellodendri* beschrieben und in einigen Stücken so versandt, zog aber dann die Beschreibung zurück, da Dr. Fixsen sie nach Stücken von Korea, die Herz sammelte, diesem zu Ehren benennen wollte.'

Syntypes 2♂, 3♀:

- ♂ with labels: handwritten (Staudinger) 'Herzi Fixsn | Phellodendri | Stgr.' (on white paper), handwritten 'Baranowsky | Dörr.[ies]' (on blue-violet paper) and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Wladiwostock | Chr.[istoph]' (on blue-violet paper), handwritten (in pencil) '6.7.[18]77' (on white paper), and printed 'Origin.' (on pink paper);
- ♀ with labels: handwritten 'Ussuri | Dörr.[ies]' (on blue-violet paper), and printed 'Origin.' (on pink paper);

- ♀ with a circle of blue-violet locality label paper and labels: small handwritten '2/7', handwritten '475.' (on white paper) and printed 'Origin.' (on pink paper);
- ♀ with a circle of blue-violet locality label paper and printed label 'Origin.' (on pink paper).

pheres Staudinger, 1886

'*Lyc.*[*aena*] *Pheretides* Ev. ... var. *pheres* Stgr.' Staudinger, 1886: 209. Type locality: 'Aus dem Gebirgen bei Namangan und vom südlichen Alai...'

Syntypes 10♂, 7♀:

- ♂ with labels: handwritten (Staudinger) 'v. Pheres | Stgr.' (on white paper), and 'Namangan | Hbh. [Haberhauer] [18]84' (on brown paper) and printed 'Origin.' (on pink paper);
- 7♂, 5♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper);
- ♂ with labels: handwritten (Staudinger) 'v. Pheres' (on white paper), and 'Alai | [18]85 Hbh. [Haberhauer]' (on brown paper) and printed 'Origin.' (on pink paper);
- ♂, 2♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper).

pheretimus Staudinger, 1892

'*Lyc.*[*aena*] *Pheres* Hb. Var. *Pheretimus* Stgr.' Staudinger, 1892d: 317. Type locality: '...23 Stücke vom Kentei (14♂♂ und 9♀♀)...'

Syntypes 2♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'Pheretes var. /Pheretimus | Stgr.' (on white paper), and 'Kentei | [18]89 Dörr.[ies]' (on green paper), printed 'Origin.' (on pink paper);
- ♂, 2♀ with circles of green locality label paper and printed label 'Origin.' (on pink paper).

pheretulus Staudinger, 1886

'*Lyc.*[*aena*] *Pheretiades* Ev. var. *Pheretulus* Stgr.' Staudinger, 1886: 209. Type locality: 'Aus den Gebirgen bei Osch und später vom Alai...'

Syntypes 9♂, 7♀:

- ♂ with labels: handwritten (Staudinger) 'v. Pheretulus | Stgr.' (on white paper), and 'Osch | Hbh. [Haberhauer] [18]82' (on brown paper), printed 'Origin.' (on pink paper) — Tshikolovets (1997a: 155, 238, pl. 40, figs 31(33));
- 3♂, 2♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper); one of the male specimens also has a small date label '19/7' (on white paper) — Tshikolovets (1997a: pl. 40, figs. 34(36));
- ♂ with labels: handwritten 'Alai | [18]85 Hbh. [Haberhauer]' (on brown paper), printed 'Origin.' (on pink paper);
- 4♂, 5♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper).

phiala Groum-Grshimaïlo, 1890

'*Lycaena Phiala* Gr. Gr.' Groum-Grshimaïlo, 1890: 366, pl. 21, fig. 4. Type locality: 'J'ai trouvé la *L. Phiala*, à un nombre fort restreint d'exemplaires, dans le Kabadian'.

Paralectotype ♂:

- ♂ with labels: handwritten (Groum-Grshimaïlo, in Russian) 'Kaba- /dian', '12 | 5.[18]85' (both on white paper), handwritten (Groum-Grshimaïlo) 'Kabadian | Buchara' (on pink paper), printed 'Orig.' (on green paper), printed 'Coll. Gr.-Gr.' (on white paper), handwritten (Staudinger) 'Phiala | Gr. Gr. | [18]97 <sic>' (on white paper).

Lectotype with the same original author's labels is deposited in Zoological Institute, Russian Academy of Sciences, St.-Petersburg (Nekrutenko, 1984a: 31, fig. 2, 2).

phlaeoides Staudinger, 1901

'*Chrysophanus* Hb. *Phlaeas* L. v. *Phlaeoides* (Knaggs in l. ?) Stgr.' Staudinger, 1901: 74. Type locality: 'Mad.[eira]'.

Syntypes 3♂, ♀:

- ♂ with handwritten (Staudinger) label 'Madeira' (on yellowish paper);

- ♀ with circle of yellow locality label paper;
- ♂ with handwritten (Staudinger) label 'Madera <sic> | 4000' Bauer' (on yellowish paper);
- ♂ with circle of yellowish locality label paper.

The specimens are placed under a handwritten (Staudinger) drawer label 'v. Phlaeoides Knags? | Stgr.' (on white paper); each provided now with a printed label '*phlaeas phlaeoides* | Staudinger, 1901 | SYNTYPUS | Y. Nekrutenko det. 1998' (on white paper).

phoenicurus Lederer, 1869

'*Polyomm.*[*atus*] *Phoenicurus* Led.' Lederer, 1869: 8, Taf. 1, Figs 4, 5. Type locality: '...bei Astrabad in Persien... Ich erhielt nur 13 Exemplaren' (*op. cit.*: 3).

Lectotype ♂:

- ♂ with labels: handwritten 'Hadschyabad' (on white paper), printed 'Origin.' (on pink paper), printed 'Coll. Led.' (on white paper), handwritten (Nekrutenko) on printed form 'LECTOTYPUS ♂ | *phoenicurus Led.* | Y. Nekrutenko design.' (on yellow paper) — Nekrutenko *in* Hesselbarth *et al.* (1995: 499).

Paralectotypes ♂, 2♀:

- ♂, 2♀ with labels: handwritten 'Hadschyabad' (on white paper), printed 'Origin.' (on pink paper), printed 'Coll. Led.' (on white paper), handwritten (Nekrutenko) on printed form 'PARALECTOTYPUS ♂ (♀) | *phoenicurus Led.* | Y. Nekrutenko design.' (on yellow paper) — Nekrutenko *in* Hesselbarth *et al.* (1995: 499).

phryxis Staudinger, 1886

'*Lyc.*[*aena*] *Phryxis* Stgr.' Staudinger, 1886: 212. Type locality: 'Bei Margelan und Namangan wurde Phryxis Ende Mai gefunden, bei Osch Ende Juni und bei Samarkand Anfang Juli. Wahrscheinlich sind sie an den letzteren beiden Lokalitäten bedeutend höher gefanden.' — Junior primary homonym and junior objective synonym of *Lycaena phryxis* Lang, 1884: 372; junior subjective synonym of *Lycaena sarta* Alphéraky, 1881 (Staudinger, 1901: 85).

Syntypes 7♂, 7♀:

- ♂ with labels: handwritten (Staudinger) 'Phryxis | Stgr.' (on white paper), and 'Margelan | Hbhr. [Haberhauer]' (on brown paper), printed 'Origin.' (on pink paper);
- 3♂, 3♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper), one male specimen also has a handwritten date label '25/5 [18]80';
- ♂ with labels: handwritten (Staudinger) 'Sarta Alph.[éraky] | Phryxis Stgr.' (on white paper), handwritten 'Osch | Hbh. [Haberhauer]' (on brown paper), handwritten date label '26/6' (on white paper) and printed 'Origin.' (on pink paper);
- ♀ with circles of brown locality label paper, handwritten date label '26/6' (on white paper) and printed label 'Origin.' (on pink paper);
- ♀ with labels: handwritten 'Namangan | Hbhr. [Haberhauer] [18]84' (on brown paper), handwritten date label '23/5' (on white paper) and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Prov. Samark.[and] | Hbh. [Haberhauer] [18]81' (on brown paper), handwritten date label '6/6' (on white paper) and printed 'Origin.' (on pink paper);
- ♂, 2♀ with circles of brown locality label paper, handwritten date label '26/6' (on white paper) and printed label 'Origin.' (on pink paper); the male specimen has a handwritten date label '6/9' (on white paper).

phyllides Staudinger, 1886

'*Lyc.*[*aena*] *Phyllis* Chr. var. *Phyllides* Stgr.' Staudinger, 1886: 225. Type locality: '...erhielt ich in geringer Anzahl aus dem Gebirgen von Namangan, Osch, Margelan und Samarkand'.

Lectotype ♂:

- ♂ with labels: handwritten 'Namangan | Hbhr. [Haberhauer] [18]84' (on brown paper), printed 'Origin.' (on pink paper), handwritten (unknown hand) '24/5 Lyc. sp. n. | Rogenhoferii' (on white paper), handwritten (Forster) 'Lectotypus ♂ | Lycaena phyllis | var. phyllides Stgr. | W. Forster 1947' (on pink

paper) — Forster (1960: 138); cf. Häuser & Eckweiler (1997: 95).

Paralectotypes 10♂, 3♀:

- ♂ with labels: handwritten (Staudinger) 'v. Phyllides | Stgr.' (on white paper), handwritten 'Osch | Hbh. [Haberhauer]' (on brown paper), small date label '6/7' (on white paper), printed 'Origin.' (on pink paper);
- ♂ with circle of brown locality label paper and printed label 'Origin.' (on pink paper);
- ♂, 2♀ with circles of brown locality label paper of the lectotype ('Namangan | Hbhr. [Haberhauer] [18]84') and printed label 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Alai | [18]85 Hbh. [Haberhauer]' (on brown paper) and printed 'Origin.' (on pink paper);
- ♂ with circle of brown locality label paper and printed label 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Prov. Samark.[and] | Hbhr. [Haberhauer] [18]81' (on brown paper) and printed 'Origin.' (on pink paper);
- 4♂, ♀ with circles of brown locality label paper, small date labels '14/5' '16/5', '23/5', '24/5', '15/5' (♀) and printed label 'Origin.' (on pink paper) — cf. Häuser & Eckweiler (1997: 95).

phyllis Christoph, 1877

'*Lycaena Damon* var. *Phyllis* Stgr. in litt.' Christoph, 1877: 237, Tab. 5, Figs 9, 10. Type locality: '...bei Schahkuh den Juli hindurch im Thale und auf den Hügeln bei etwa 7000' hinauf recht häufig.'

Lectotype ♂:

- ♂ with labels: circle of yellow paper, Christoph's date label '11/7' ('11' on white, '7' on pink background, recto white/pink, verso pink), printed '327.' (on white paper faded yellow), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Forster) 'Cotypus ♂ | Lycaena phyllis | Christoph' (on pink paper), new handwritten (Häuser) 'Hadschyabad' (on white

paper), printed, with handwritten (Wagener, in pencil) insertion 'Abgebildet in Hesselbarth, | van Oorschot & Wagener: | Tagfalter der Türkei | Tafel *121* Figur *33*' (on white paper), printed '**Lectotypus** | *Polyommatus (Agrodiaetus)* | ***phyllis*** (Christoph, 1877) | des. ECKWEILER & TEN HAGEN 1998' (on red paper, in box) — Eckweiler & ten Hagen (1998: 113, Abb. 7–9); cf. Hesselbarth *et al.* (1995: 752, Taf. 121, Fig. 33, Taf. 128, Figs 66, 72); Häuser & Eckweiler (1997: 95); Eckweiler & Häuser (1997: Pl. 9).

Paralectotypes 5♂, 3♀:

- ♂ with labels: handwritten 'Schakuh | Chr.[istoph]' (on yellow paper), printed '326.' (on white paper faded yellow) and handwritten (Forster) 'Cotypus ♂ | Lycaena phyllis | Christoph' (on pink paper) — Forster (1960: 135);
- 3♂, 3♀ with circles of yellow locality label paper;
- ♂ with labels: handwritten 'Hadschyabad' (on white paper), printed, with handwritten insertion '*Damon* | Coll. Led.' (on white paper) — cf. Eckweiler & ten Hagen (1998: 113).
- 2♂, 2♀ designated with printed labels '**Paralectotypus** | *Polyommatus (Agrodiaetus)* | ***phyllis*** (Christoph, 1877) | des. ECKWEILER & TEN HAGEN 1998' (on bluish paper, in box).

poseidon Herrich-Schäffer, [1851]

'[*Lycaena*] *Poseidon* Kad.' Herrich-Schäffer, [1851] **6**(48): 24. Type locality: 'Aus Kleinasien'.

Types: not found (cf. Häuser & Eckweiler, 1997: 95).

poseidon Lederer, 1852

'*Lycaena* * *Poseidon* Kdm. [Kindermann] in lit.' Lederer, 1852: 20 (nomen nudum; * designates 'was nicht echt europäisch' — *op. cit.*: 15); '*Lycaena Poseidon Kinderm.*[*ann*] (nicht Kaden) in lit.' Lederer, 1852: 37. Type locality: ['asiatische Türkei'?]. — Junior primary homonym of *Lycaena poseidon* Herrich-Schäffer, [1851].

Types: not found (cf. Häuser & Eckweiler, 1997: 96).

poseidonides Staudinger, 1886

'*Lyc.*[*aena*] *Poseidon* var. *Poseidonides* Stgr.' Staudinger, 1886: 225. Type locality: 'Vier ♂ vom südlichen Alai sowie eins von den südlich von Samarkand gelegenden Gebirgen...'

Syntypes 5♂:

- ♂ with labels: handwritten (Staudinger) 'v. Poseidonides | Stgr.' (on white paper), handwritten 'Prov. Samark.[and] | Hbhr. [Haberhauer] [18]81' (on brown paper), small date label '12/7' (on white paper) printed 'Origin.' (on pink paper) and printed 'Zool. Mus. | Berlin' (on pale yellow paper);
- ♂ with labels: handwritten 'Alai | [18]89 Hbh. [Haberhauer]' (on brown paper), printed 'Origin.' (on pink paper) and printed 'Zool. Mus. | Berlin' (on pale yellow paper);
- ♂ with circle of locality label brown paper, handwritten (Staudinger) label 'v. Poseidonides | Stgr. | Alai' (on white paper) and printed 'Origin.' (on pink paper);
- 2♂ with circles of brown locality label paper, printed label 'Origin.' (on pink paper), one of them with printed label 'Zool. Mus. | Berlin' (on pale yellow paper) and two new handwritten labels 'poseidonides' (in ball pencil) and 'Alai' (in pencil), both on white paper (cf. Häuser & Eckweiler, 1997: 96).

posthumus Christoph, 1877

'*Lycaena Damon* var. *Posthumus* Chr.' Christoph, 1877: 238, Tab. 5, Fig. 11. Type locality: 'Ich fand den Schmetterling nur von 9–11,000' auf dem Schahkuh-Gebirge, wo er vereinzelt im Juli flog'.

Lectotype ♂:

- ♂ with labels: handwritten 'Schahkuh | Chr.[istoph]' small date label '26/V' ('26' on white, 'V' on pink background, recto white/pink, verso pink), printed '329.' (on white paper faded yellow), handwritten (Forster) 'Cotypus ♂ | Lycaena damon | var. posthumus | Christ.' (on pink paper), printed '**Lectotypus** | *Polyommatus (Agrodiaetus)* | ***posthumus*** (Christoph, 1877) | des. Eckweiler & ten Hagen 1998' (on red paper, in box) — Forster (1960: 141); Häuser & Eckweiler (1997: 96); Eckweiler

& Häuser (1997: Pl. 9); Eckweiler & ten Hagen (1998: 113, Abb. 10–12).

Paralectotypes 3♂, 3♀:

- ♂ with labels: handwritten (Christoph?) 'vom 9000' <illegible>', printed '330.' (on white paper faded yellow), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Forster) 'Cotypus ♂ | Lycaena damon | var. posthumus | Christ.' (on pink paper) — Forster (1960: 141);
- ♀ with circle of yellow locality label paper;
- 2♂ with circles of yellow locality label paper and small date labels '8/7' and '26/7';
- ♀ with labels: circle of yellow paper, handwritten Christoph's date label '2/7', printed label '331.' (on white faded yellow paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Forster) 'Cotypus ♀ | Lycaena damon | var. posthumus | Christ.' (on pink paper) and new 'Astrabad | coll. Stgr.' (on white paper) — Forster (1960: 141);
- ♀ with labels: circle of yellow paper, handwritten Christoph's date label '18/7', printed label '328.' (on white faded yellow paper), handwritten (Forster) 'Cotypus ♀ | Lycaena damon | var. posthumus | Christ.' (on pink paper) — Forster (1960: 141); cf. Eckweiler & ten Hagen (1998: 113).

♂ and 3♀ designated with labels '**Paralectotypus** | *Polyommatus (Agrodiaetus)* | ***posthumus*** (Christoph, 1877) | des. Eckweiler & ten Hagen 1998' (on bluish paper, in box).

praemerisina Lorković, 1943

'*Everes argiades merisina* n. Frühjahrsform *praemerisina* n.' Lorković, 1943: 451, Taf. 25, Fig. 12, Taf. 26, Fig. 11. Type locality: 'China, Kwang-tung, Gao-fung.' — Infrasubspecific.

Holotype ♂:

- ♂ with labels: printed, with handwritten insertion 'China Kwantung | *Gao fung* | *8. 5.*[19]*17* | R. Mell' (on white paper), handwritten (Forster <sic>) on printed form 'Holo-Type

<corrected to Typ*us*> ♂ | *Everes argiades* | *praemerisina Lorkovic*' (on pink paper), handwritten original field label 'GF 8. V. 17 | 3 u.<?> 4 (recto) | <text in Chinese> (verso)' (on white paper, in pencil, folded);

Paratypes 6♂, 3♀:

- 5♂, 3♀ with labels: printed, with handwritten insertion 'China Kwantung | *Gao fung* | <different dates late April and early May> .[19]*17* | R. Mell' (on white paper), handwritten (Forster <sic>) on printed form 'Para-Typus ♂ (♀) | *Everes argiades* | *praemerisina Lorkovic*' (on pink paper);
- ♂ with labels: printed, with handwritten insertion 'China Kwantung | *Lung tao shan* | *18. 4.*[19]*17* | R. Mell' (on white paper), handwritten (Forster <sic>) on printed form 'Para-Typus ♂ | *Everes argiades* | *praemerisina Lorkovic*' (on pink paper).

Some specimens have also original field labels (folded).

pretiosa Staudinger, 1886

'*Lyc.*[*aena*] *Pretiosa* Stgr.' Staudinger, 1886: 209. Type locality: 'Diese Art erhielt ich in Anzahl der Umgegend von Margelan und Namangan.' — Junior primary homonym and junior objective synonym of *Lycaena pretiosa* Lang, 1884: 370.

Syntypes 7♂, 6♀:

- ♂ with labels: handwritten (Staudinger) 'Pretiosa | Stgr.' (on white paper), handwritten 'Margelan | Hbhr. [Haberhauer]' (on brown paper) and printed 'Origin.' (on pink paper);
- 5♂, 3♀ with circles of brown locality label paper and printed 'Origin.' (on pink paper);
- ♂ with labels handwritten 'Namangan | Hbhr. [Haberhauer] [18]84' (on brown paper) and printed 'Origin.' (on pink paper);
- 3♀ with circles of brown locality label paper and printed 'Origin.' (on pink paper).

privata Staudinger, 1896

'*Lyc.*[*aena*] *Chiron* Hufn. v. *Privata* Stgr.' Staudinger, 1896: 300. Type locality: '...wurden mir von Herrn R Tancré eingesandt, dessen Sammler E. Rückbeil sie in den Jahren 1892 uns 1893 im Innern Tibets, zwischen dem Lob Noor und Kuku Noor, fand.'

Syntypes ♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'Chiron var. | Privata | Stgr.' (on white paper), handwritten 'Kuku Noor | [18]94 <sic! – *lapsus calami*? – see above under *Type locality*> Rckbl. [Rückbeil]' (on brown paper) and printed 'Origin.' (on pink paper);
- 2♀ with circles of brown locality label paper, one specimen also has a small square piece of pink paper.

prunoides Staudinger, 1887

'*Thecla Prunoides* Stgr.' Staudinger, 1887b: 129, pl. 6, fig. 1, a, b. Type locality: '...besitze ich 1 ♂ und 3 ♀♀, die Christoph Mitte Juli bei Wladiwostok fing, so wie ein (altes) ♀, das Kindermann 1852 bei Ust-Kamenogorsk im Altai-Gebiet fand und das in Lederer's Sammlung steckte.'

Syntypes ♂, 4♀:

- ♂ with labels: handwritten (Staudinger) 'Prunoides | Stgr. in litt.' (on white paper), handwritten 'Wladiwostock | Chr.[istoph]' (on blue paper), small handwritten '16/7' (recto white, verso red), printed 'Origin.' (on pink paper);
- 3♀ with circles of blue locality label paper, small handwritten labels '16 | 7', '10 | 7', '16' and printed 'Origin.' (on pink paper);
- ♀ with labels: circle of blue paper, handwritten 'Ustkam.[enogorsk] | 1852' (on white paper), printed, with handwritten insertion '*W-album*' <sic> | Coll. Led.' (on white paper), printed 'Origin.' (on pink paper).

pseudocyanea Forster, 1956

'*Agrodiaetus xerxes pseudocyanea* ssp. nov.' Forster, 1956: 120, Taf. 12, Figs 6, 7, Taf. 13, Figs 6, 7. Type locality: 'Achalzich'. — Junior subjective synonym of *Lycaena damone cyanea* Staudinger, 1899 (Carbonell, 2000: 213, 215).

Holotype ♂:

- ♂ with labels: handwritten 'Achalzich | Hbhr. [Haberhauer] [18]82' (on green paper), small handwritten '24/5' ('24' on white background, '5' on pink background; recto white/pink, verso pink), printed '319.' (on white paper faded yellow), printed 'Origin.' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Forster) on printed form 'Cotypus | *Lycaena damone* | *cyanea Stgr.*' (on pink paper), handwritten (Forster) on printed form 'Holo-Typ*us* <overwritten to correct 'Type'> ♂ | *Polyommatus xerxes* | *pseudocyanea Forster* | W. Forster München' (on pink paper), printed, with handwritten (Wagener, in pencil) insertions 'Abgebildet in Hesselbarth, | van Oorschot & Wagener: | Tagfalter der Türkei | Tafel *123* Figur *37*' (on white paper) — Forster (1956: Taf. 12, Fig. 6, Taf. 13, Fig. 6); Hesselbarth *et al.* (1995: Taf. 123, Fig. 37); Häuser & Eckweiler (1997: 97); see also *cyanea* Lederer paralectotype above.

Allotype ♀:

- ♀ with labels: small handwritten date label '4/6 <or 4/8?>', printed '320.' (on white paper faded yellow), printed 'Origin.' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Forster) on printed form '*Co*-Typus ♀ | *Lycaena damone* | *cyanea Stgr.*' (on pink paper), handwritten (Forster) on printed form 'Allo-Typ*us* <overwritten to correct 'Type'> ♀ | *Polyommatus xerxes* | *pseudocyanea Forster* | W. Forster München' (on pink paper), printed, with handwritten (Wagener, in pencil) insertions 'Abgebildet in Hesselbarth, | van Oorschot & Wagener: | Tagfalter der Türkei | Tafel *124* Figur *50*' (on white paper) — Forster (1956: Taf. 12, Fig. 7, Taf. 13, Fig. 7); Hesselbarth *et al.* (1995: Taf. 124, Fig. 50).

pseudoxerxes Forster, 1956

'*Agrodiaetus carmon pseudoxerxes* ssp. nov.' Forster, 1956: 118, Taf. 9, Figs 3–5, Taf. 13, Figs 3–5. Type locality: 'Persia s.[eptentrionale] Elburs mts., Schahkuh' (holotype).

Paratypes 8♂, 12♀:

- ♂ with labels: handwritten 'Schakuh | Chr.[istoph]' (on yellow paper), small date label '9/7', a small square piece of paper; printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Forster) on printed form 'Para-Typus ♂ | *Agrodiaetus carmon* | *pseudoxerxes Forster* | W. Forster München' (on pink paper, in box);
- ♀ with labels: circle of yellow paper, printed '290.' (on white to yellow paper), handwritten (Forster) on printed form 'Para-Typus ♀ | *Agrodiaetus carmon* | *pseudoxerxes Forster* | W. Forster München' (on pink paper, in box) and handwritten (Wagener) 'Schahkuh | Chr.[istoph]' (on white paper);
- ♂ with labels: circle of yellow paper, small date label '15/7', printed '298.' (on white to yellow paper) and handwritten (Forster) on printed form 'Para-Typus ♂ | *Agrodiaetus carmon* | *pseudoxerxes Forster* | W. Forster München' (on pink paper, in box);
- 3♂, ♀ with same circles of yellow paper and small date labels that apparently belong to the type series;
- ♂ with labels: printed, with handwritten insertions 'HYRCANIA, (Schahkuh) | *Funke 1898*' (on white paper, in box), handwritten (Püngeler) 'carmon' (on white cross-lined notebook paper) and handwritten (Forster) on printed form 'Para-Typus ♂ (♀) | *Agrodiaetus carmon* | *pseudoxerxes Forster* | W. Forster München' (on pink paper);
- 2♂, 9♀ with labels: printed, with handwritten insertions 'HYRCANIA, (Schahkuh) | <*some with different dates*>' (on white paper, in box), handwritten (Püngeler) and handwritten (Forster) on printed form 'Para-Typus ♂ (♀) | *Agrodiaetus carmon* | *pseudoxerxes Forster* | W. Forster München' (on pink paper);
- ♀ with labels: handwritten 'Hyrcania' (on white paper, in box) and handwritten (Forster) on printed form 'Para-Typus ♂ (♀) | *Agrodiaetus carmon* | *pseudoxerxes Forster* | W. Forster München' (on pink paper) — see also Häuser & Eckweiler (1997: 97).

psittacus Herrich-Schäffer, [1844]

'*Lycaena Psittacus*' Herrich-Schäffer, [1844] **1**(7): Tab. 48, Figs 220–223; [1845] **1**(10): 129. Type locality: 'Aus der Türkei, auch von der asiatischen Seite.' — Junior subjective synonym of *Lycaena balkanica* Freyer, [1843] (Staudinger, 1871a: 9; 1901: 76).

Types: not found.

psylorita Freyer, [1845]

'*Lycaena Pap.*[*ilio*] *Psylorita*' Freyer, [1845] **5**(79): 146, Tab. 469, Figs 3, 4. Type locality: 'Von Dr. Frivaldzky <sic> habe ich zwei Exemplare von diesem Tagfalter unter obigen Namen erhalten... Nach der mir von Herrn Dr. Frivaldzky <sic> gegebenen Nachricht fliegt dieser Falter im Juni auf dem Berge Ida auf der Insel Creta'.

Syntype ♂:

- ♂ with labels: handwritten 'Psylorita | Friv. H Sch. f. 328–31 | Frey. n. B. t. 469. | Creta Friv.' (on white paper, in printed box), printed '4713' (on white paper).

Catalogus Generalis: 4713 — see Appendix.

The specimen is provided now with a printed label '*psylorita* Freyer, [1845] | SYNTYPUS | Y. Nekrutenko det. 30.11.1998' (on yellow paper).

pusillargus Strand, 1919

'*Lycaena semiargus* Rott. f. *pusillargus* m.' Strand, 1919: 18. Type locality: 'Marburg'. — Infrasubspecific.

Holotype ♀ (by monotypy):

- ♀ with labels: printed 'Deutschland | Marburg i.[n] H.[essen] | E. Strand, [190]8. | 7.07' (on white paper), handwritten (Strand) on printed form *Lycaena* | *semiargus* | *Rott. f. pu* | *silargus* <*sic*> *m.* ♀ | Strand det.' (on white paper) and printed 'Type' (on dirty-pink paper).

quercivora Staudinger, 1887

'*Thecla Quercivora* Stgr.' Staudinger, 1887b: 137, pl. 6, fig. 2, a, b. Type locality: [Amur-Gebiet]: '...erhielt ich nur drei erzogene Stücke durch Dörries, die mir alle Weibchen zu sein scheinen'.

Syntypes 3♀:

- ♀ with labels: handwritten (Staudinger) 'Signata | Butl. | Quercivora | Stgr.' (on white paper), handwritten 'Askold | [18]83 Dörr.[ies]' (on violet-blue paper), small handwritten '11' and printed 'Origin.' (on pink paper);
- ♀ with labels: handwritten 'Suifun | [18]85 Dörr.[ies]' (on violet-blue paper) and printed 'Origin.' (on pink paper);
- ♀ with circle of blue locality label paper and printed 'Origin.' (on pink paper).

quercus Kardakoff, 1928

'*Zephyrus taxila* Brem. f.. ♀ *quercus* (nom. coll.)' Kardakoff, 1928: 271, Taf. 7, Fig. 16. Type locality: '...aus dem Ussurigebiet...' — Infrasubspecific.

Syntype ♀:

- ♀ with labels: printed, with handwritten (Kardakoff?) insertion '*Sidemi* Ussurigebiet | *5.8. 1921.* N. Kardakoff' (on white paper), handwritten (Kardakoff?) 'Zephyrus taxila Brem L. | f. ♀ quercus Kardakoff' (on white paper) and printed 'Typus' (on red paper, in box).

The specimen is placed under typewritten drawer label 'f. ♀ quercus' <underlined with red pencil> (on a stripe of white paper, in blue type ribbon).

***rebeli* Hirschke, 1905**

'*Lycaena Alcon* F. v. *Rebeli*' Hirschke, 1905: 110, Taf. 2, Figs 1, 2. Type locality: 'Den ganzen Sommer 1904 verbrachte ich in Steiermark und erbeutete dort im zirka 1700 *m* Höhe eine auffallende, in beiden Geschlechtern äußerst constante Lycaena-Form... Von den in Anzahl erbeuteten Exemplaren, welche untereinender keine Abweichungen zeigen, lagen zur Beschreibung 4 ♂ und 4 ♀ vor.'

Syntypes 2♂, ♀:

- 2♂, ♀ with labels: printed, with handwritten (Hirschke?) insertion 'Hirschke. Wien | *Styria* | *VII. 1904* | *Co=Typ* (recto) | *alcon var.* | *Rebeli* ♂ (♀) | *Cotype* <double underlined> | *1/*[19]*06 v.*[om] *H. Hirschke* (verso, written by Püngeler)' (on white paper, recto in printed box), handwritten (Püngeler) on

printed form 'Cotype <underlined> | *v. Rebeli Hirschke* ♂ (♀) | *vom Autor* | *Püngeler*' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Alcon F. | v. Rebeli Hirschke' (on white paper, in printed box).

rezniceki Bartel, 1904

'*Lycaena coridon* var. *rezniceki* nov. var.' Bartel, 1904: 117. Type locality: 'Eine weitere, noch unbeschriebene Lokalform von Lyc. coridon kommt an der Riviera vor.' 'Fluggebiet: Rapallo (Riviera di Levante 1.–10. Juni 1904), Monte Carlo (10.–13. Juni 1904, E. v. Reznicek). – Auch von Bordhigera und Nizza bekannt.'

Syntype ♂:

- ♂ with labels: printed 'Gall.[ia] mer.[idionalis] or.[ientalis] | Riviera V ♂ | coll. M. Bartel' (on white paper, in box), handwritten (Püngeler) on printed form 'Cotype <underlined> | *v. Rezniceki Bartel* |. ♂ | *vom Autor* | 2.1905 | Püngeler' (on pink paper).

rileyi Forster, 1940

'*Zephyrus rileyi* spec. nov.' Forster, 1940: 871, Taf. 22, Figs 1, 2, Taf. 23, Figs 1, 2. Type locality (holotype): 'China, Kwangtung, Lin ping.'

Holotype ♂:

- ♂ with labels: printed, with handwritten insertion 'China Kwantung | *Lin ping* | *25.5.*[19]*21* | R. Mell' (on white paper), handwritten (Mell) 'Lp [Ling ping] 25.V.[19]21' (on white paper, in pencil, folded), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Forster) on printed form 'Holo-Type ♂ | *Thecla (Zephyrus)* | *rileyi Forst.* | W. Forster München' (on pink paper, in box), printed, with handwritten (Howarth) insertion 'T.G.H. | 1955 | *152*' (on white paper), two printed, with handwritten (Howarth) insertion 'Neg. No. *17767*' and 'Neg. No. *17768*' (both on white paper).

Allotype ♀:

- ♀ (abdomen missing), with labels: printed, with handwritten insertion 'China Kwantung | *Lung tao shan* | *30.6.*[19]*17* |

R. Mell' (on white paper), handwritten (Mell) field label 'Dr 30.VI.[19]17' (on white paper, in pencil, verso with text in Chinese in Indian ink, folded), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Forster) on printed form 'Allo-Type ♀ | *Thecla (Zephyrus)* | *rileyi Forst.* | W. Forster München' (on pink paper, in box), printed, with handwritten (Howarth) insertion 'Neg. No. 17764' (on white paper).

Paratypes 2♀:

- ♀ with labels: printed, with handwritten insertion 'China Kwantung | *Lung tao shan* | *30.6.*[19]*17* | R. Mell' (on white paper), handwritten (Mell) field label 'Dr 30.VI.17' (on white paper, in pencil, verso with text in Chinese in Indian ink and 'Zeph. paraiberica' <?>, folded), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Forster) on printed form 'Para-Type ♀ | *Thecla (Zephyrus)* | *rileyi Forst.* | Dr. W. Forster München' (on pink paper, in box);
- ♀ with labels: printed, with handwritten insertion 'China Kwantung | *Lung tao shan* | *12.6.*[19]*17* | R. Mell' (on white paper), handwritten (Mell) field label 'Dr 12.VI.17' (on white paper cut from a newsletter, in pencil, verso with text in Chinese in Indian ink and <illegible> <?>, folded), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Forster) on printed form 'Para-Type ♀ | *Thecla (Zephyrus)* | *rileyi Forst.* | Dr. W. Forster München' (on pink paper, in box).

The holotype and allotype are figured by Forster (*op. cit.*) on Tafel 22 and 23, Abb. 1, 2; when compared to the present state of the specimens, it becomes clear that they were exposed to high humidity and an apparently inaccurate treatment, resulting in changes in the position of the wings and antennae and the loss of the abdomen.

rippertii Boisduval, 1832

'*Argus Rippertii*' Boisduval, 1832: 68, pl. 16, figs 4–6. Type locality: '...aux environs de Digne, ou il a été découvert en 1829 par M. Rippert de Beaugency...' — Junior subjective synonym of *Lycaena ripartii* Freyer, 1830.

Syntypes 2♂, ♀:

- ♂ with labels: handwritten 'Rippertii | Boisd.[uval] Ic. Hb. f. 958 | Frey. H Sch. | Alp.[ae] Gallopr.[ovinciales] Boisd' (on white paper, in printed box), printed '4715' (on white paper);
- ♂, ♀ without any label.

Catalogus Generalis: 4715 — see Appendix; cf. Häuser & Eckweiler (1997: 99).

The specimens are provided now with a printed label '*rippertii* Boisduval, [1832] | SYNTYPUS | Y. Nekrutenko det. 30.11.1998' (on yellow paper). For a lectotype designation see Bálint (1999: 54–55): the present specimens thus become paralectotypes.

romanovi Christoph, 1882

'*Thestor Romanovi* n. sp.' Christoph, 1882: 106. Type locality: 'Hier folgt die Beschreibung einiger als neu erkannter, fast nur von Ordubat stammenden Arten' (op. cit.: 106).

Paralectotypes 4♂, 2♀:

- ♂ with handwritten label 'Ordubat | Cauc.[asus] m.[eridionalis] or.[ientalis] | Chr.[istoph]' (on green paper);
- ♂ with handwritten label 'Ordubat | | Chr.[istoph]' (on green paper) and small elongated handwritten (Christoph) label 'Ordub.[at] 32.5.[18]81' (on white paper, in much faded ink);
- 2♂, 2♀ with circles of green locality label paper; of these, two male specimens with small elongated handwritten (Christoph) label 'Ordub.[at] 32.5.[18]81' (on white paper, in much faded ink), two female specimens with small handwritten (Christoph) date labels '15/5' and '24/5' (recto yellowish white, verso deep blue, almost black).

Lectotype designated by Nekrutenko *in* Hesselbarth *et al.*, 1995: 506 (deposited in Zoological Institute, Russian Academy of Sciences, St.-Petersburg, Russia). Additional evidence in support to the label date of forementioned specimens as belonging, as an integral part, to Christoph's type series who shared it with Staudinger, a quotation from Romanoff (1884: 48) is given: '*Romanovi* Chr.

(Pl. I, fig. 1 et 2). — C'est au printemps de 1881 que M. Christoph a découvert ce nouveau *Thestor* dans les environs d'Ordoubad.' The specimens are provided now with labels '*romanovi* | Christoph, 1882 | PARALECTOTYPUS | Y. Nekrutenko det. 13.11.1998' (on yellow paper) (ICZN Art. 74.1.3, Recommendation 74F).

rosacea Austaut, 1885

'*Lycaena Theophrastus* Fabr. v. *Rosacea*' Austaut, 1885: 141. Type locality: '...est fondée sur une douzaine d'exemplaires ♂ que j'ai reçus des hauteurs situées entre El-Arricha et le Maroc.'

Syntypes 4♂:

- ♂ with labels: handwritten (Staudinger) 'v. Rosacea | Aust.[aut]' (on white paper), handwritten (Staudinger) 'Marocco | Aust.[aut]' (on white paper) and printed 'Origin.' (on pink paper);
- 3♂ with circles of white locality label paper and printed 'Origin.' (on pink paper).

rueckbeili Forster, 1960

'*Agrodiaetus iphigenia rückbeili* ssp. (f. alt?) nov.' Forster, 1960: 126, Taf. 10, Figs 21, 22, Taf. 11, Figs 21, 22. Type locality (holotype): 'Ost-Turkestan, Aksu 1900 leg. Rückbeil'.

Paratypes 3♂:

- ♂ with labels: printed, with handwritten (Püngeler) insertions 'Ost-Turkestan | (Aksu) | Rückbeil 1900' and handwritten (Forster) on printed form 'Para-Typus ♂ | *Polyommatus (Agrodiaetus)* | *iphigenia rückbeili Forst.* | W. Forster München' (on pink paper, in box);
- 2♂ with labels: printed, with handwritten (Püngeler) insertions 'Ost-Turkestan | (Aksu) | Rückbeil 1900' and handwritten (Forster) on printed form 'Para-Typus ♂ | *Polyommatus (Agrodiaetus)* | *iphigenia rückbeili Forst.* | W. Forster München' (on pink paper, in box) — cf. Forster *op. cit.*: 126 under *Variabilität* entry; Häuser & Eckweiler (1997: 100).

rufopunctatus Neuburger, 1907

'*Lycaena icarus* Rott. ab. *rufopunctatus*' Neuburger, 1907: 180. Type locality: 'Beschrieben nach einem ♂ aus Beirut in Syrien...' — Infrasubspecific.

Holotype ♂ (by monotypy):

- ♂ with labels: printed 'Syria | Beirut | Neuburger' (on white paper, in box), large handwritten (Neuburger?) 'Lycaena icarus Rott. | ab. rubropunctatus | Neubgr.' (on white faded yellowish lined notebook paper), printed 'Type' (on pink-brownish paper).

***rutilans* Staudinger, 1886**

'*Lyc.*[*aena*] *Rutilans* Stgr.' Staudinger, 1886: 208. Type locality: 'Diese interessante neue Art erhielt ich erst kürzlich in 12 meist nicht ganz reinen Stücken vom südlichen Alai, wo sie im Juni (oder Juli) von Haberhauer und Maurer gefunden wurden.'

Syntypes 6♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'Rutilans | Stgr.' (on white paper), handwritten 'Alai | [18]85 Hbh. [Haberhauer]' (on brown paper) and printed 'Origin.' (on pink paper) — figured in Tshikolovets (1997b: 36, figs 5, 6);
- 5♂, 2♀ with circles of brown locality label paper and printed 'Origin.' (on pink paper).

***saphirina* Staudinger, 1887**

'*Thecla Saphirina* Stgr.' Staudinger, 1887b: 135, pl. 16, figs 3–5. Type locality: '...aus dem Amur-Gebiet erhielt ich nur ein ♂ und 2 ♀♀ von der Insel Askold durch Dörries...'

Syntypes ♂, 2♀:

- ♂ (abdomen missing), with labels: handwritten (Staudinger) 'Saphirina | Stgr.' (on white paper), handwritten 'Askold | Dör.[ries]' (on bluish paper), printed 'Origin.' (on pink paper), two handwritten (Dantchenko) in red ink '♂ saphirinus | 8.03.96 | Dantchenko | abdomen' and '1' (both on white paper);
- 2♀ with circles of bluish locality label paper and printed label 'Origin.' (on pink paper).

sarthus Staudinger, 1886

'*Pol.*[*yommatus*] *Sarthus* Stgr. n. sp.' Staudinger, 1886: 202. Type locality: 'Von dieser neuen Art erhielt ich im vorigen Jahre nur 4 Stücke (3 ♂ 1 ♀) von den Herren Haberhauer und Maurer, die sie im südlichen Alai Gebirge, wohl beim Kara Kasuk Paß gefangen haben.'

Syntypes 3♂, ♀:

- ♂ with labels: handwritten (Staudinger) 'Sarthus | Stgr.' (on white paper), handwritten 'Alai | [18]85 Hbh. [Haberhauer]' (on brown paper) and printed 'Origin.' (on pink paper);
- 2♂, ♀ with circles of brown locality label paper and printed 'Origin.' (on pink paper).

sassanides Kollar, 1849

'*Thecla Sassanides Kllr.*' Kollar, 1849: 10. Type locality: not specified; 'Südpersien'.

Syntypes 2♂:

- ♂ with labels: handwritten 'Sassanides | Koll.[ar] Verh. Wien. Ac. | I p. 10 | Persia Kollar' (recto yellow, in printed box, verso white), printed '4117' (on white paper);
- ♂, pinned underside up, with a printed label '4340' (on white paper).

Catalogus Generalis: 4340 — see Appendix.

The specimens are provided now with a printed label '*sassanides* Kollar, 1849 | SYNTYPUS | Y. Nekrutenko det. 29.11.1998' (on yellow paper).

satraps Staudinger, 1878

'*Pol.*[*yommatus*] *Satraps* (Ld. coll.) Stgr. n. sp.' Staudinger, 1878: 230. Type locality: 'Unter diesem Namen hatte Lederer ein abgeflogenes ♂ aus Külek, von ihm selbst gefangen, in seiner Sammlung stecken. Haberhauer fing 1875 eine grössere Anzahl bei Tersus (sic; recte Tarsus) und Dorak (auch Taurus)...' — Junior subjective synonym of *Polyommatus asabinus* Herrich-Schäffer, [1851] (Staudinger, 1881: 65).

Lectotype ♂:

- ♂ with labels: handwritten 'Taurus | Hbhr. [Haberhauer]' (on yellow paper), printed 'Origin.' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten '28', handwritten (Nekrutenko) on printed form 'LECTOTYPUS ♂ | *satraps Stgr.* | Y. Nekrutenko design.' (on yellow paper) — Nekrutenko *in* Hesselbarth *et al.* (1995: 494).

Paralectotypes 10♂, 6♀:

- 9♂, 5♀ with circles of yellow locality label paper and printed labels 'Origin.' (on pink paper); one male has handwritten labels 'Külek' (on white paper) and (Lederer) 'Satraps m.[ihi]' (on white paper, in printed box), printed 'Coll. Led.' (on white paper) and 'Origin.' (on pink paper);
- ♂, ♀ with labels: handwritten (Püngeler) 'Taurus' (on white paper, in printed box) and handwritten (Püngeler) on printed form 'Cotype <underlined> | *v. satraps Stgr.* ♂ (♀) | *vom Autor* | *Püngeler*' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Asabinus HS. | v. Satraps Stgr.' (on white paper, in printed box).

schmidti Kardakoff, 1928

'*Lycaena orion* Pall. ab. *schmidti* (nov.)' Kardakoff, 1928: 272, Taf. 7, Fig. 18. Type locality: 'Gefangene ♂♂ am 9.V. in der Umg.[egend] v.[on] Wladiwostok.' — Infrasubspecific.

Syntype ♂:

- ♂ with labels: printed, with handwritten (Kardakoff?) insertion 'Wladiwostok | S. Ussurigebiet | *9*.V. 192*1*. N. Kardakoff' (on white paper), handwritten (Kardakoff?) 'Lycaena orion Pall. | ab. schmidti Kardakoff' (on white paper) and printed 'Typus' (on red paper, in box).

The specimen is placed under a typewritten drawer label 'ab. schmidti' <underlined with red pencil> (on a stripe of white paper, in blue type ribbon).

scudderi Möschler, 1874

'*Lycaena Scudderi* Edw. Proc. Ac. Nat. Sc. Phil. 1861, p. 164' Möschler, 1874: 155. Type locality: 'in einigen Exemplaren von Labrador erhielt...' — Misidentified; junior primary homonym of *Lycaena scudderi* Edwards, 1861; oldest available name: *Lycaena aster* Edwards, 1882 (Staudinger, 1901: 79).

Syntype ♂:

- ♂ with labels: handwritten (Püngeler) 'Labrador m.[eridionalis] | Scudderi Möschl. ♂, | Cotype, <underlined> 12. [18]75 v.[om] Möschler' (on white paper), handwritten (Püngeler) on printed form 'Cotype <underlined> | *Scudderi Möschl. ?* | *Püngeler*' (on pink paper).

The specimen is placed under a handwritten (Püngeler) drawer label 'Aster Edw.' (on white paper, in printed box). As may be seen from the label, the specimen was received by Püngeler from Möschler in December 1875 (he was then 18!) and was later on designated as a 'Cotype'. The question mark on the pink label apparently related not to the specimen status as a syntype, but rather to its identity with *aster* Edwards (cf. drawer label).

scylla Staudinger, 1887

'*Lycaena Scylla* Stgr.' Staudinger, 1887b: 139, pl. 16, fig. 7. Type locality: '...erhielt ich in grösserer Anzahl durch Christoph, die sie von Ende Juni bis mitte Juli bei Raddefka fand.'— Junior primary homonym of *Lycaena scylla* Oberthür, 1880, junior primary homonym and junior objective synonym of *Lycaena scylla* Lang, 1884; junior subjective synonym of *Lycaena lycormas* Butler, 1866 (Staudinger, 1901: 88).

Syntypes 9♂, 3♀:

- ♂ with labels: handwritten (Staudinger) 'Scylla | Stgr.' (on white paper), handwritten (Staudinger) 'lycormas | Butl.' (on cross-lined notebook white paper), handwritten (Staudinger) 'Ob Lycormas Butl.?' (on white paper) handwritten 'Raddefskaja | Chr.[istoph]' (on violet-blue paper) and printed 'Origin.' (on pink paper);
- 7♂, 3♀ with circles of violet-blue locality label paper and printed label 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Ussuri | Dörr.[ies]' (on violet-blue paper) and printed 'Origin.' (on pink paper).

septentrionalis Grum-Grshimaïlo

Unpublished.

Syntypes ♂, ♀:

- ♂ with labels: handwritten (Grum-Grshimaïlo?) 'Ural mer. | [18]88 Gr. Gr.' (on green paper), 'Ural | Donz.[elii] | v. Septentrio- | nalis G-G' (on white paper, in red ink), handwritten (Grum-Grshimaïlo, in Russian) 'Salda | VII [18]88' (on white paper);
- ♀ with a circle of green locality label paper and handwritten (Grum-Grshimaïlo, in Russian) 'Salda | VI [18]88' (on white paper).

As evidence in support that this material was collected by Grum-Grshimaïlo during his expedition to the Ural, a quotation from his itinerary description follows: 'Next 1888 Grigoriy Efimovich (first and patronymic names of Grum-Grshimaïlo), on his own funds, with just a limited support of the Academy of Sciences of the Zoological Museum, has undertaken an expedition to the Central Ural. The aim of the voyage remained the same: mostly zoogeographical.

G. E. started a survey of the Central Ural from the South, from Zlatoust, and concluded at the Irbit latitude. On his arrival back, he forwarded all his entomological collections to the Zoological Museum.' (Grumm-Grshimaïlo, 1947: 26).

Salda is a populated place in Sverdlovskaya Oblast' (Russian Federation), on a river with the same name (ca. 170 km N of Yekaterinburg, 58° 21' 17" N, 60° 18' 9" E).

sibirica Staudinger, 1892

'*Lyc.*[*aena*] *Optilete* Fab. var. *Cyparissus* Hb. (var. Sibirica Stgr.)' Staudinger, 1892d: 317. Type locality: '...in Anzahl vom Kentei...'

Syntypes 5♂, 3♀:

- ♂ with labels: handwritten (Staudinger) 'var. Sibirica | Stgr.' (on white paper), handwritten 'Kentei | [18]89 Dörr.[ies]' (on green paper) and printed 'Origin.' (on pink paper);

- 4♂, 3♀ with circles of the green locality label paper and printed label 'Origin.' (on pink paper).

sibirica Staudinger, 1899

'[*Lycaena*] *Damone* Ev. var. *Sibirica*' Staudinger, 1899: 139. Type locality: '...vom Altai und Tarbagatai...' — Junior primary homonym of *Lycaena optilete sibirica* Staudinger, 1892; oldest available name: *Lycaena altaica* Elwes, 1899.

Syntypes 4(6?) ♂:

- ♂ with labels: handwritten (Staudinger) 'var. | Sibirica | Stgr.' (on white paper), 'Saisan | Hbhr. [Haberhauer]' (on brown paper), handwritten date label '1/8', handwritten '66' and printed 'Origin.' (on pink paper);
- 3♂ with circles of brown locality label paper, two of them with printed 'Origin.' (on pink paper);
- ?-♂ with labels: handwritten (O. Bang-Haas) large 'Damone' with glued handwritten (Staudinger) 'Sibirica | Stgr' (on white paper, Bang-Haas in pencil, Staudinger in black ink), printed 'Ongodai, | Altai Mts., | Berezowsky, | 1898' and printed 'Origin.' (on pink paper) (apparently a subsequent designation by Bang-Haas);
- ?-♂ with labels: handwritten 'Altai alp.[es] (recto) | Damone var. | Sibirica ♂ | von | A. Bang-Haas 1/[19]02 (verso)' (on white paper, recto in printed box), handwritten (Püngeler) on printed form 'Cotype <underlined> | *v. sibirica Stgr.* ♂ | *v.*[on] *B.-Haas* | Püngeler' (on pink paper) and handwritten (Forster) on printed form '*Polyommatus* | *(Agrodiaetus)* ♂ | *damone* | *sibirica Stgr.* | det. W. Forster 19*44* (or *47*?)' (on white paper) — see also (Häuser & Eckweiler, 1997: 102).

In the Staudinger collection there are ♂ and 2♀ with printed labels 'Ongodai | Altai Mts. | 3-5000 feet | June [18]98 <*12 July* overwritten in red ink> A. Jacobson', one male and one female specimens have printed labels '380' and '381' (on white paper faded yellow) and handwritten (Forster) labels on printed form '*Polyommatus* | *(Agrodiaetus)* | *damone* ♂ (♀)| *sibirica Stgr.* | det W. Forster 19*47*' (on white paper), all have printed labels 'Zool. Mus. | Berlin' (on pale yellow paper). Male specimen has a

handwritten (Bálint) label on printed (in red ink) form 'Lectotypus | *P. (Agrodiaetus)* | *sibiricus Stgr.* (recto) | *des. by* | *Zs. Bálint 1989.I* (verso)' (on white paper, recto in box); female (without printed number label) 'Paralectotypus | *P. (Agrodiaetus)* | *sibiricus Stgr.* (recto) | *des. by* | *Zs. Bálint 1989.I* (verso)' (on white paper, recto in box).

The designation above is unavailable for two reasons: (1) it has never been published; (2) the specimens designated do not belong to the type series (not designated with Staudinger's 'Origin.' labels, apparently received by Staudinger after the original description was published);

The specimens are placed under a handwritten (Püngeler) drawer label 'Damone Ev. | v. Sibirica Stgr.' (on white paper, in printed box); provided with printed labels: 'Designatio per schedam | IRRITA: | non syntypus, non edita | Y. Nekrutenko det. 3.12.1998' (on violet paper).

sidemina Kardakoff, 1928

'*Zephyrus taxila* Brem. ab. *sidemina* (nov.)' Kardakoff, 1928: 271, Taf. 7, Fig. 17. Type locality: 'Ich habe nur ein ♂ gefangen. ... Gefangen am 16.VII in Sidemi'. — Infrasubspecific.

Holotype ♂ (by monotypy):

- ♂ with labels: printed, with handwritten insertion '*Sidemi* Ussurigebiet | *29.7.* 192*1.* N. Kardakoff' (on white paper), handwritten (Kardakoff?) 'Zephyrus taxila Brem L. | ab sidemina Kardakoff' (on white paper) and printed 'Typus' (on red paper, in box).

The specimen is placed under a typewritten drawer label 'ab. sidemina' <underlined with red pencil> (on a stripe of white paper, in blue type ribbon).

***sieversii* Christoph, 1873**

'[*Lycaena*] *Sieversii* Chr.' Christoph, 1873: 23, Tab. 1, Fig. 1, 2. Type locality: 'war sowohl bei Tasch, als auch Schahkuh, von 4–10,000', stets vereinzelt zu finden'.

Syntypes 4♂, ♀:

- ♂ with labels: handwritten (Christoph) 'Fasch <sic> | Chr.[istoph]' (on yellow paper), printed 'Origin.' (on pink paper);
- ♂, ♀ with circles of yellow locality label paper and with small date labels '18/7' and '1/6';
- ♂ with labels: handwritten (Christoph) 'Schahkuh | Chr.[istoph]' (on yellow paper), printed 'Origin.' (on pink paper);
- ♂ with circles of yellow locality label paper and with small date label '16/6'.
- 3♀ not designated with Staudinger's 'Origin.' label, also have Christoph's small date labels.

The specimens are placed under a handwritten drawer label 'Sieversii | Chr. | Mirza Stgr.' (on white paper, in printed box), each provided now with a printed label '*sieversii* Christoph, 1873 | *mirza* Staudinger, 1874 | SYNTYPUS | Y. Nekrutenko det. 1.12.1998' (on yellow paper) — see *mirza* above.

sinensis Alphéraky, 1881

'*L.*[*ycaena*] *Sinensis* Alph. n. sp.' Alphéraky, 1881: 383, tab. 14, fig. 7. Type locality: 'district de Kouldjà... sur l'un des promontoires du Tian-Chan'.

Syntypes 2♂:

- ♂ (hindwings and abdomen missing) with labels: handwritten (Alphéraky) 'Th.[ecla] Sinensis | Alph.[éraky] /Tian-Chan' (on white paper), circle of brown paper, small date label '14/V [1879]' and printed 'Origin.' (on pink paper);
- ♂ with labels: handwritten 'Tian Schan | Alph.[éraky]' (on brown paper), and a small date label '14/V [1879]'.

The specimens are provided now with a printed label 'sinensis | Alphéraky, 1881 | SYNTYPUS | Y. Nekrutenko det. 3.12.1998' (on yellow paper).

splendens Staudinger, 1881

'*Polyomm.*[*atus*] *Splendens* Stgr. n. sp.' Staudinger, 1881: 280. Type locality: 'Von dieser wohl sicher hoch gefangenen Art sandte Haberhauer 20 Stücke ein…' (*l. c.*: 280), 'Ala Tau; Thian. [Schan] oc.[cidentalis] et m.[eridionalis], Iss.[yk] K.[ul] oc.[cidentalis]' (Staudinger, 1901: 74).

Syntypes 4♂, 4♀:

- ♂ with labels: handwritten 'Ala Tau | Hbhr. [Haberhauer]' (on brown paper) and printed 'Origin.' (on pink paper);
- 3♂, 4♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper).

standfussi Grum-Grshimaïlo, [1891]

'*Polyommatus Standfussi*' Grum-Grshimaïlo, [1891]: 450. Type locality: 'In montibus ad Sinin, in regione Amdo dicta, detectus'.

Syntypes ♂, ♀:

- ♂ with handwritten labels: 'Thibet | Sinin Alp.[es] | [18]90 [legit] Gr. Gr.' (on brown paper) and 'Pol.[yommatus] | Standfussi | G.G. | Sinin Mont.[es]' (A. Bang-Haas, on white faded paper);
- ♀ with circle of brown locality label paper.

The specimens, undoubtedly received by Staudinger from Grum-Grshimaïlo, are provided now with a printed label '*standfussi* | Grum-Grshimailo [1891] | SYNTYPUS | Y. Nekrutenko det. 26.11.1998' (on yellow paper).

staudingeri Christoph, 1873

'*Lycaena Staudingeri* Chr.' Christoph, 1873: 26, Tab. 1, Fig. 5, 6. Type locality: 'Ich erhielt nur 2 ♂ und 2 ♀ bei Tasch...'

Syntype ♂:

- ♂ with labels: handwritten 'Tasch | Chr.[istoph]' (on yellow paper), small date label '31/5' (on paper faded brown) and printed 'Origin.' (on pink paper).

The specimen is placed under a handwritten drawer label 'Staudingeri | Chr.' (on white paper, in box).

suaveola Staudinger, 1881

'*Thecla Rubi* L. und v.? *Suaveola*' Staudinger, 1881: 279. Type locality: '...von Lepsa und Saisan... Vier ♂ (davon eins aus Saisan)...'

Lectotype ♂:

- ♂ (antennae broken off), with labels: handwritten 'Lepsa | Hbhr. [Haberhauer]' (on brown paper), printed 'Origin.' (on pink paper), handwritten in pencil 'Callophrys | rubi var. | suaveola | Stgr.' (on white paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Bernardi) on printed form '*C. suaveola Stgr.* | *lectotype* ♂ | *Alexanor III : 276* | Bernardi dét. | *1964*' (on white paper) and combined printed/handwritten designation label '*LECTO*TYPE' (on red paper) — Bernardi (1964: 276); figured in Hesselbarth *et al.* (1995: Taf. 127, Fig. 31, 37).

Paralectotypes 3♂:

- 2♂ with circles of brown locality label paper and printed 'Origin.' (on pink paper), one of them has a handwritten label in pencil 'suaveola | Stgr.' (on white paper);
- ♂ with labels: handwritten 'Saisan | Hbhr.' (on brown paper) and printed 'Origin.' (on pink paper).

sultan Staudinger, 1886

'*Polyommatus Sultan* Stgr. n. sp.' Staudinger, 1886: 202. Type locality: '...im Juli in den südlichen Gebirgen bei Samarkand gefangen, die Haberhauer mir als Hazret Sultan Gebirge angab.' — Junior primary homonym and junior objective synonym of *Polyommatus sultan* Lang, 1884: 368 (Nekrutenko, 1983: 11).

Syntypes 4♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'Sultan | Stgr.' (on white paper), 'Prov Samark.[and] | Hbh. [Haberhauer] [18]81' (on brown paper) and printed 'Origin.' (on pink paper);
- 3♂, 2♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper).

superba Staudinger, 1887

'*Lycaena Superba* Stgr.' Staudinger, 1887a: 51. Type locality: '...erhielt ich jetzt 6 ♂ und 2 ♀ aus dem Transalai von Herrn Maurer... 2 ♂ von Haberhauer aus dem Alai erhalten hatte.'

Syntypes 5♂, 3♀:

- ♂ with labels: handwritten (Staudinger) 'Superba | Stgr.' (on white paper), handwritten 'Alai | [18]85 Hbh. [Haberhauer]' (on brown paper) and printed 'Origin.' (on pink paper);
- ♀ (abdomen missing), with labels: handwritten (Staudinger) 'Superba ♀ von | mir als <crossed> unter | Venus-♀♀ beschrieben' (on white paper), 'Alai | [18]85 Hbh. [Haberhauer]' (on brown paper) and printed, with handwritten (Staudinger) insertion 'Origin. | *Venus* ♀ | *false*' (on pink paper);
- ♂ with labels: handwritten 'Transalai | [18]86 Maur.[er]' (on brown paper) and printed 'Origin.' (on pink paper);
- 3♂, 2♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper), one male specimen also has a handwritten (Staudinger) label 'Superba Stgr.' (on white paper) — Häuser & Eckweiler (1997: 103).

taherides Eckweiler, 1998

'*Polyommatus* (*Agrodiaetus*) *erschoffii taherides* subsp. nov.' Eckweiler, 1998: 225, Farbtafel 2. Type locality (holotypus): 'Iran, Khorasan, Kuh-e-Sorkh (Ost), S Kallehmenar, 45 km S Fariman, 2300–2400 m'.

Paratype ♂:

- ♂ with printed labels: 'Iran, Khorasan | 45 km S Fariman | Kallehmenar 2300–2400 m | 15.-17.VII.1998 | leg. Eckweiler 548' (on white paper, in box) and '**Paratypus** | *Polyommatus (Agrodiaetus)* | *erschoffii* ***taherides*** subsp. nov. | ECKWEILER 1998' (on bluish paper, in box).

tancrei Graeser, 1888

'*Lycaena Tancrei* Graeser.' Graeser, 1888: 77. Type locality: 'Diese neue Art wurde von mir bei Nicol.[ajefsk], auf eine Bergwiese, am oberen Laufe der Kamera, in Mehrzahl gefangen.'

Syntypes ♂, ♀:

- ♂, ♀ with labels: printed 'Nicolajefsk' (on dirty white paper, in box), handwritten (Püngeler) 'Tancrei ♂ | Original <underlined> | 11/09 ex coll. | Dieckmann' (on white paper), handwritten (Püngeler) on printed form 'Cotype <underlined> | *Tancrei Graes*[er] ♂ (♀) | *Püngeler*' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Tancrei Graes.[er]' (on white paper, in printed box).

tartarus Staudinger, 1896

'*Lycaena Orbitulus* Esp. var. *Tartarus* Stgr.' Staudinger, 1896b: 300. Type locality: 'wurden mir von Herrn R Tancré eingesandt, dessen Sammler E. Rückbeil sie in den Jahren 1892 und 1893 im Innern Tibets, zwischen dem Lob Noor und Kuku Noor, fand.' — Junior subjective synonym of *Lycaena orbona* Grum-Grshimaïlo, 1891: 452 (Staudinger, 1901: 81).

Syntypes 2♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'Orbitulus var. | Tartarus | Stgr. (recto) | v. Orbona | GrGr. | Tartarus | Stgr. (verso)' (on white paper), handwritten 'Kuku Noor | [18]94 <sic! – *lapsus calami*? – see above under *Type locality*> Rckbl. [Rückbeil]' (on brown paper) and printed 'Origin.' (on pink paper);
- ♂, 2♀ with circles of brown locality label paper, two female specimens also with rectangular pieces of pink paper.

tekessana Alphéraky, 1897

'*Lycaena Pheretiades* Ev. var. *Tekessana* Alph. nova' Alphéraky, 1897: 234, pl. 12, fig. 3. Type locality: 'C'est le 4 Juillet 1893 que l'expédition Roborowsky-Kozlow rencontra cette jolie *Lycaena* sur le fleuve Tékesse, dans le Thian-Chan. Nous avons devant nous 6 ♂♂ et une ♀ de cette race...'

'Syntype' ♂:

- ♂ with labels: handwritten (Staudinger) 'var. Tekessana | Alph.[éraky]' (on white paper, handwritten 'Kuldja | Rkbl. [Rückbeil] [18]84' (on brown paper) and printed 'Origin.' with handwritten (Staudinger) insertion (illegible) (on pink paper).

This specimen does not belong to the Alphéraky type series, and its designation by Staudinger as an 'Original' (apparently for internal use) is not available.

thebana Staudinger, 1895

'*Lyc.*[*aena*] *Thebana* B. (?)' Staudinger, 1895: 244, Taf. 9, Fig. 3. Type locality: 'Unter diesem Namen steckte ein ♂ aus Cairo in Lederer's Sammlung, Boisduval scheint aber diese Art nicht beschrieben zu haben.'

Holotype ♂ (by monotypy):

- ♂ with labels: handwritten (Lederer) 'Thebana B.[oisduval] | Cairo' (on white paper, in printed box), handwritten (Staudinger) 'Thebana | Stgr.' (on white paper), handwritten 'Cairo' (on white paper), printed 'Coll. Led.' (on white paper) and 'Origin.' (on pink paper).

The specimen is provided with a printed label '*thebana* Staudinger, 1895 | HOLOTYPUS (par monotypiam) | Y. Nekrutenko det. 28.10.1998' (on red paper).

thetis Klug, 1834

'*Lycaena Thetis*' Klug, 1834: Decas Quarta: Signature *l*(i), Tab. 40, Figs 17, 18. Type locality: 'Habitat in Syria'.

Types: not found; *Catalogus Generalis*: 4557 — see Appendix.

transcaspica Staudinger, 1899

'[*Lycaena*] *Damone* Ev. var. *Transcaspica*' Staudinger, 1899: 141. Type locality: '...aus Transcaspien (Achal Tekke), wo sie in den an Persien grenzenden Gebirgen (wohl bei Nochur)...'.— Junior primary homonym and junior objective synonym of *Lycaena kindermanni transcaspica* [Heyne], [1895].

Syntypes 5♂, 3♀ (Lectotype?):

- ♂ with labels: handwritten (unknown hand; Heyne?) 'Kindermani <sic> | v. Transcaspica | Transcauc <sic> | [18]94 U. S. (or U. 5.?)' (on white faded paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Forster) on printed form '*Para*-Typus ♂ | *Lycaena transcaspica* | *Stgr.*' (on pink paper), printed, with handwritten (Wagener, in pencil) insertions 'Abgebildet in Hesselbarth, | van Oorschot & Wagener: |

Tagfalter der Türkei | Tafel *119* Figur *2*' (on white paper) — not figured;

- ♂ with labels: handwritten (Staudinger) 'var. Transcaspica | Tekke Stgr. | N. ed.<?–illegible> (recto) | Kindermanni | v. Transcaspica | Stgr. i. l.' (verso), a circle of yellow paper and printed 'Origin.' (on pink paper);
- 2♂, ♀ with circles of yellow paper (which might be interpreted as 'Tekke [18]94 | Wild') and printed label 'Origin.' (on pink paper) — cf. Eckweiler & Häuser (1997: 121, Pl. 5);
- ♀ with labels: handwritten (unknown hand; Heyne?) 'Kindermani <sic> | v. Transcaspica | Transcauc <sic> | [18]94 U. S. (or U. 5.?)' (on white faded paper), printed 'Sammlung | Daumiller' (on white paper), handwritten (Forster) on printed form '*Para*-Typus ♀ | *Lycaena transcaspica* | *Stgr.*' (on pink paper);
- [Lectotype] ♂ with labels: handwritten 'Tekke | 94 Wild.', printed 'Origin.' (on pink paper), printed '295.' (on white paper faded yellow), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten 'transcaspica' (on white paper), handwritten (Forster) 'Typus | Lycaena | transcaspica Stgr.' (on pink paper), printed, with handwritten (Wagener, in pencil) insertions 'Abgebildet in Hesselbarth, | van Oorschot & Wagener: | Tagfalter der Türkei | Tafel *121* Figur *63*' (on white paper) — Hesselbarth *et al.* (1995: Taf. 121, Fig. 63).
- [Paralectotype] ♀ with circle of yellow locality label paper, printed 'Origin.' (on pink paper), printed '296.' (on white paper faded yellow), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Forster) 'Typus ♀ | Lycaena | transcaspica | Stgr.' (on pink paper), handwritten (Wagener) 'Tekke [18]94 | Wild', printed, with handwritten (Wagener, in pencil) insertions 'Abgebildet in Hesselbarth, | van Oorschot & Wagener: | Tagfalter der Türkei | Tafel *121* Figur *64*' (on white paper) — Hesselbarth *et al.* (1995: Taf. 121, Fig. 64).

The designation of the two last-mentioned specimens as 'Types' and its subsequent publication ('1♂♀ Transcaspien, Tekke 1894 (Typen in Slg. Staudinger)' — Forster, 1956: 80) may be

considered as an available lectotype designation; only these two specimens are declared to be the syntypes of '*Lycaena damone* Ev. var. *transcaspica*' Staudinger, 1899 (Hesselbarth *et al.*, 1995: 735, footnote 3; see also Häuser & Eckweiler, 1997: 105).

transcaspica Staudinger, 1901

'*Cigaritis* B. *Acamas* Klug. v. *Transcaspica* Stgr.' Staudinger, 1901: 76. Type locality: 'Tura oc.[cidentalis] m.[eridionalis] mont; (Nuchur)'.

Syntypes 2♂:

- ♂ with labels: handwritten 'Tekke | [18]94 Wild.[?]' (on yellow paper), and printed 'Origin.' (on pink paper);
- ♂ with circles of yellow locality label paper and printed labels 'Origin.' (on pink paper).

The specimens are placed under a handwritten (Staudinger) drawer label 'v. Transcaspica | Stgr.' (on white paper).

transcaucasica Rebel, 1901

'*Lycaena Argyrognomon* Brgst. var. *Transcaucasica* n. var. ♂♀' Rebel, 1901: 166. Type locality: '...gehören doch die aus Südarmenien von Eriwan und Kulp von Herrn Korb 1898 und 1901 mitgebrachten *Argyrognomon*-Stücke...'

Syntypes ♂, ♀:

- ♂, ♀ with labels: handwritten 'Armenia (recto) | Lyc.[aena] argus var ♂ (♀) | v.[om] Mkorb 11/[19]01 (verso)' (on white paper, recto in printed box), printed, with handwritten insertion 'Russ.[isch] Armen.[ien] | *Kulp* | 1901 Korb' (on white paper), handwritten (Püngeler) on printed form 'Cotype <underlined> | *v. transcaucasica* | *Rbl.* ♂ (♀) | *Püngeler*' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Argyrognomon Bgstr. | v. Transcaucasica Rbl.' (on white paper, in printed box).

transiens Staudinger, 1886

'*Pol.*[*yommatus*] *Caspius* Led. var. *Transiens* Stgr.' Staudinger, 1886: 201. Type locality: 'Von Haberhauer erhielt ich 1881 eine größere Anzahl im Juli bei Samarkand (in den südlich davon gelegenen Gebirgen)...'

Syntypes 6♂, 4♀:

- ♂ with labels: handwritten (Staudinger) 'Caspius var. | Transiens | Stgr.' (on white paper), 'Prov. Samark.[and] | Hbh. [Haberhauer] [18]81' (on brown paper) and printed 'Origin.' (on pink paper);
- 5♂, 4♀ with circles of brown locality label paper and printed 'Origin.' (on pink paper).

triphysina Staudinger, 1892

'*Lycaena Triphysina* Stgr. n. sp.' Staudinger, 1892a: 235, Taf. 3, Fig. 2. Type locality: '...erhielt ich durch Herrn Tancré; sie wurde von Rückbeil im Kaschgar-Gebiet gefangen'.

Syntypes 4♂, 2♀:

- ♂ with labels: handwritten (Staudinger) 'Triphysina | Stgr.' (on white paper), 'Kaschgar | [18]90 Rckbl [Rückbeil]' (on brown paper) and printed 'Origin.' (on pink paper);
- 2♂, 3♀ with circles of brown locality label paper and printed labels 'Origin.' (on pink paper).

uliginosa Dannehl, 1921

'*L.*[*ycaena*] *argus Schiff. var. uliginosa*' Dannehl, 1921: 39. Type locality: 'Eine der interessantesten Erscheinungen der Beuerberger Fauna.'

Syntypes 3♂, 5♀:

- 3♂, 5♀ with labels: printed 'O. Bayern | Beuerberg | c.[oll.] Dannehl [19]20', small handwritten date labels (on white paper, in pencil) handwritten (Püngeler) on printed form 'Cotype <underlined> | *v. uliginosa Dannehl* ♂ (♀) | *von Dr. Frhr v. Rosen* | *Püngeler*' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Argyrognomon Bgstr. | v. Uliginosa Dannehl' (on white paper, in printed box).

unicolor Kardakoff, 1928

'*Zephyrus taxila* Brem. f. ♀ *unicolor* (nom. coll.)' Kardakoff, 1928: 271, Taf. 7, Fig. 13. Type locality: '...aus dem Ussurigebiet...' — Infrasubspecific.

Syntype ♀:

- ♀ (right hindwing and abdomen missing), with labels: printed, with handwritten (Kardakoff?) insertion '*Sidemi* Ussurigebiet | *6.8.* 192*1.* N. Kardakoff' (on white paper), handwritten (Kardakoff?) 'Zephyrus taxila Brem L. | f. ♀ unicolor Kardakoff' (on white paper) and printed 'Typus' (on red paper, in box).

The specimen is placed under a typewritten drawer label 'f. ♀ unicolor' <underlined with red pencil> (on a stripe of white paper, in blue type ribbon).

vandalusica Staudinger, 1871

'*Thecla Spini* Schiff. S. V. ab. ♀ *Lynceus* Hb. 674-5 (*Lynceus* Esp. n. syn.); Vandalusica Ld. z. b. 1852, p. 19'. — Unjustified emendation of *vandulusica* Lederer, 1852 (see below); the name has been already emended by Lederer himself (1857: 32): '*Lycaena* Fab. *spini* S. V. V.[arietas] *vandalusica* m. (*Lynceus* Hb.)'.

Types: not found.

vandulusica Lederer, 1852

'*Thecla Lynceus* Hb. v. *Vandulusica*' Lederer, 1852: 19. — A replacement name for junior secondary homonym *Thecla spini lynceus* (Hübner, [1813]), non *Thecla lynceus* (Esper [1777]), junior subjective synonym of *Papilio spini* [Denis & Schiffermüller], 1775 (cf. Lederer, 1857: 32; Staudinger, 1871a: 7 as *vandalusica*) — see vandalusica above.

venus Staudinger, 1886

'*Lyc.*[*aena*] *Venus* Stgr.' Staudinger, 1886: 211. Type locality: 'Diese prächtige neue Art erhielt ich erst vor Kurzem aus dem südlichen Alai in 10 ♂ und 6 ♀ eingesandt.'

Lectotype ♂:

- ♂ with labels: circle of brown paper, printed 'Origin.' (on pink paper), handwritten (Lukhtanov) on printed form 'Lectotypus ♂ | *venus Stgr.* design. *V. Lukhtanov*' (on white paper, recto red, verso white) — Lukhtanov & Lukhtanov (1994: 272).

Paralectotypes 5♂, 4♀:

- ♂ with labels: handwritten (Staudinger) 'Venus | Stgr.' (on white paper), and 'Alai | [18]85 Hbhr. [Haberhauer]' (on brown paper), printed 'Origin.' (on pink paper);

- 4♂, 4♀ with circles of brown locality label paper and printed label 'Origin.' (on pink paper); one ♂ destroyed, head, thorax and abdomen removed, forewings pinned to the specimen in a piece of notebook paper; labelled with a new handwritten label 'Alai | 85 Htsch' <sic> and printed label 'Zool. Mus. | Berlin' (on pale yellow paper).

violaceus Staudinger, 1892

'*Pol.*[*yommatus*] *Dispar* Haw. Var. *Violaceus* Stgr. (und var. Dahurica Graes.?)' Staudinger, 1892d: 315. Type locality: '...Ende Juli, auf einer hoch-gelegenen Waldwiese des Kentei gefangen.'

Syntypes 3♂, ♀:

- ♀ with labels: handwritten (Staudinger) 'var. | Violaceus | Stgr.' (on white paper), 'Kentei | [18]89 Dörr.[ies]' (on green paper) and printed 'Origin.' (on pink paper);
- 3♂ with circles of green locality label paper and printed 'Origin.' (on pink paper).

virgaureola Staudinger, 1892

'*Polyommatus Virgaureae* L. var. *Virgaureola* Stgr.' Staudinger, 1892d: 314. Type locality: '...auf höher gelegenen Wiesen im Kentei'.

Syntypes 5♂, 7♀:

- ♂ with labels: handwritten (Staudinger) 'var. | Virgaureola | Stgr.' (on white paper), 'Kentei | [18]89 Dörr.[ies]' (on pale green paper) and printed 'Origin.' (on pink paper);
- 3♂, 6♀ with circles of pale green locality label paper and printed 'Origin.' (on pink paper); one male specimen also has a handwritten (Staudinger) label 'var. | Virgaureola' with an addition in pencil 'Kentei' (on white paper);
- ♂, ♀ with labels: handwritten (Püngeler) 'Transbaical | (Kentei) | Stgr. (recto) | Polyo.[mmatus] virgaureae | v. virgaureola Stgr. | ♂ (♀) | ex coll. Heydenr.[eich] | 9.[18]98 (verso)' (on white paper, recto in printed box) and handwritten (Püngeler) on printed form 'Cotype <underlined> | *v. virgaureola Stgr.* ♂ (♀) | *Püngeler*' (on pink paper).

The specimens are placed under a handwritten (Püngeler) drawer label 'Virgaureae L. | v. Virgaureola Stgr.' (on white paper, in printed box).

xerxes Staudinger, 1899

'[*Lycaena*] *Damone* Ev. var. *Xerxes*' Staudinger, 1899: 143. Type locality: '...wurde von Christoph bei Schahrud in Nord-Persien im Mai 1873 gefangen; er sandte mir 4♂♂ und 3♀♀ davon.'

Lectotype ♂:

- ♂ with a circle of yellow locality label paper, printed '325' (on white paper faded yellow), printed 'Origin.' (on pink paper), handwritten (Forster) on printed form '*Lecto*-Typus ♂ | *Polyommatus xerxes* | *Stgr.* | W. Forster München' (on pink paper, in box) — Forster (1956: 122); Häuser & Eckweiler (1997: 108).

Paralectotypes 3♂, 3♀:

- ♂ with labels: handwritten (Staudinger) 'Kindermanni | v. Xerxes | Stgr.' (on white paper), handwritten 'Schahrud | Chr.[istoph]' (on yellow paper), handwritten small (Christoph) date label '10/5' (recto white, verso green), printed 'Origin.' (on pink paper), handwritten (Forster) 'Cotypus | Lycaena damone | xerxes Stgr.' (on pink paper);
- 2♂, 3♀ with circles of yellow locality label paper and printed 'Origin.' (on pink paper), one male and one female have also a handwritten (Forster) label 'Cotypus | Lycaena damone | xerxes Stgr.' (on pink paper), some of these also have Christoph's small date labels '20/5', '22/5', '26/5' (recto white, verso green).

The specimens are placed under a handwritten (Staudinger) drawer label 'v. Xerxes.' (on white paper).

zeituna Forster, 1960

'*Agrodiaetus phyllis zeituna* (Stgr. i. l.) ssp. nov.' Forster, 1960: 129, Taf. 10, Fig. 23, Taf. 11, Fig. 23. Type locality: 'Zeitun' (Turkey, Maraş, Süleymanlı).

Holotype ♂:

- ♂ with labels: handwritten (Staudinger) 'Iphigenia v. | Zeituna i. l.' (on white paper), handwritten 'Zeitun | [18]98 Har.<?>'(on white paper faded yellow), printed '306.' (on white paper faded yellow), printed 'Origin.' (on pink paper), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Forster) on printed form 'Holo-Typ*us* <overwritten to correct 'Type'> ♂ | *Polyommatus (Agrodiaetus)* | *phyllis zeituna Forster* | W. Forster München' (on pink paper), printed, with handwritten (Wagener, in pencil) insertions 'Abgebildet in Hesselbarth, | van Oorschot & Wagener: | Tagfalter der Türkei | Tafel *121* Figur *27*' (on white paper) — Forster (1960: Taf. 10, Fig. 23, Taf. 11, Fig. 23); Hesselbarth *et al.* (1995: Taf. 121, Fig. 27); Häuser & Eckweiler (1997: 108).

Paratype ♂:

- ♂ with labels: a circle of yellow paper, printed '307.' (on white paper faded yellow), printed 'Zool. Mus. | Berlin' (on pale yellow paper), handwritten (Forster) on printed form 'Para-Typus ♂ | *Agrodiaetus phyllis* | *zeituna Forster* | W. Forster München' (on pink paper).

zephyrinus Christoph, 1884

'*Lycaena Zephyrinus* Stgr.' Christoph, 1884: 102, pl. 4, fig. 3a, b. Type locality: 'Im Mai bei Askhabad... später bei Nuchur gesammelten aus.'

Syntypes ♂, ♀

- ♂ with handwritten (Staudinger): labels: 'als Zephyrinus | von Christoph' (on white paper), 'Nochur Teke | Christ.[oph]' (on yellow paper), and small label '75/6';
- ♀ with handwritten (Christoph) square label 'No- | chur | 29582 [29 May 1882] (recto) | Chr.[istoph] (verso)' (on white paper, recto in violet box).

Other syntypes with Christoph's identical handwritten labels are deposited in the Zoological Institute, Russian Academy of Sciences, St.-Petersburg.

The specimens are provided with a printed label '*zephyrinus* Christoph, 1884 | SYNTYPUS | Y. Nekrutenko det., 29.10.1998'.

zephyrinus Staudinger, 1886

'*Lyc.*[*aena*] *Zephyrus* HS. var. *Zephyrinus* Stgr.' Staudinger, 1886: 204. Type locality: '...erhielt ich besonders aus der Umgegend von Samarkand und Namangan, wo sie Ende Mai flog, aber auch von Usgent und Osch, wo sie Mitte Juli gefangen wurde.' — Junior primary homonym of *Lycaena zephyrinus* Christoph, 1884 (Staudinger, 1901: 79); replacement name: *Plebeius pylaon usbeka* Forster, 1939: 6.

Syntypes 7♂, 9♀:

- ♂ (abdomen removed), with printed labels 'Origin.' (on pink paper) and 'Zool. Mus. | Berlin' (on yellow paper), handwritten (Bálint) on printed form '*Plebejides* | *usbekus FORST.* | gen. prep. No. | Zs. Bálint *37*', handwritten (Bálint) on printed form 'Lectotypus | *Lycena zephyrinus* | *STGR.* | *Plebeius* | *usbeka FORSt.* <sic>'(print in red ink, in box), 'Lectotypus | *Plebejides* | *usbekus FORST.* (recto) | *det. BÁLINT*, | *1986.XII* (verso)' (on white paper, print in red ink, in box);
- ♂ (right forewing missing), with labels: handwritten (Staudinger) 'Zephyrus var. | Zephyrinus | Stgr.' (on white paper), handwritten 'Prov. Samarkand | Hbhr. [Haberhauer] [18]81' (on brown paper), printed 'Origin.' (on pink paper);
- 3♂, 4♀ with circles of brown locality label paper and printed labels 'Origin.' (on pink paper); one male specimen also has a handwritten (Staudinger) label 'Zephyrus var. | Zephyrinus Stgr.' (on white paper);
- ♀ with circle of brown locality label paper, printed labels 'Origin.' (on pink paper) and 'Zool. Mus. | Berlin' (on yellow paper), handwritten (Bálint) labels on printed form 'Paralectotypus | *Lycena zephyrinus* | *STGR.* = *Plebeius* | *usbeka FORST.*' (on white paper, print in red ink, in box), 'Paralectotypus | *Plebejides* | *usbekus* FORST. (recto) | *det. BÁLINT,* | *1986.XII* (verso)' (on white paper, print in red ink, in box);
- ♀ with labels: handwritten 'Osch | Hbhr. [Haberhauer] [18]82' (on brown paper), handwritten small date label '13/6' (on white paper) and printed 'Origin.' (on pink paper);

- ♂ with labels: handwritten 'Namangan | Hbhr. [Haberhauer] [18]84' (on brown paper) and printed 'Origin.' (on pink paper);
- ♂, 2♀ with circles of brown locality label paper and printed 'Origin.' (on pink paper); the male specimen also has a handwritten small date label '28/5', female specimens '27/5' and '28/5' (on white paper);
- ♀ with labels: handwritten 'Usgent | Hbhr. [Haberhauer] [18]83' (on brown paper) and printed 'Origin.' (on pink paper).

No information related to these specimens in connection with the lectotype designation has been published yet by Bálint ('I have examined closely the syntypes of *zephyrinus* (Staudinger)...' — Bálint & Kertész, 1990: 203–204).

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Appendix

An extraction from *Catalogus Generalis Musei Zoologici Berolinensis*. Vol. 1 (inventory nos 1–3753), Vol. 2 (inventory nos 3754–10098) showing recorded type specimens of the Lycaenidae.

Inventory no.	Species	Specimens no.	Locality	Collector/ Provider
*4091	Iolaus Ismenias Kl.	1	Ambukol	Ehrenberg
*4105	Aphnaeus Acamas Kl.	5	Syria	Ehrenberg
*4106	Aphnaeus Acamas Kl.	1	Arabia fel.	Ehrenberg
4117	Deudorix Livia Kl.	1	Arabia fel.	Ehrenberg
4118	" " " " "	[1]	[Aegypt]	[Ehrenberg]
4340	Thecla Sassanides Koll.	2	Persia	Kollar
4341	Thecla Myrtale Kl.	3	Syria	Ehrenberg
4353	Thecla Spini F. Var. Melantho	2	Syria	Ehrenberg
*4554	Chrysophanus Thersamon F. Var. Omphale Kl.	7	Syria	Ehrenberg
*4557	Chrysophanus Thetis Kl.	4	Syria	Ehrenberg
4679	Lycaena Astraea Frey.	2	Amasia	Kindermann
4713	Lycaena Psylorita Friv.	2	Creta	Frivaldszky
4715	Lycaena Rippertii Bsd.	4	Alp. Gallopr.	Boisduval
4721	Lycaena Hopfferi Kind.	2	Amasia	Kindermann
4723	Lycaena Actis HSch.	2	Amasia	Kindermann
4724	Lycaena Iphigenia Friv.	4	Constantinop.	Frivaldszky

Missing specimens are marked with an asterisk.

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Material. Holotype @, Turkey, Hakkari, 8 km E. of Uludere, 1200 m, 10.VI.1984, H. van Oorschot leg. (ITZA). Paratypes: 7@, 3#, labelled as holotype; @, #, "Achalzich Chambobel 1910 Korb" (NHMW); 2@, #, Iraq, Kurdistan, Sersang, 1500 m, L. Higgins leg. (BMNH); @, Iraq, "Shaqlawa, 2500 ft, Kurdistan, 15/24 May 1957" L. G. Higgins leg. (BMNH).

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Higgins, L. G., 1950. A descriptive catalogue of the Palaearctic *Euphydryas* (Lepidoptera: Rhopalocera). — *Trans.R.ent.Soc.Lond.* 101: 435–489, figs. 1–44, 7 maps.

Higgins, L. G. & Riley, N. D., 1980. A field guide to the butterflies of Britain and Europe. 4th ed. — Collins, London. 384 p., 63 pls.

Staudinger, O., 1901. Famil. Papilionidae - Hepialidae. *In*: Staudinger, O. & Rebel, H. Catalog der Lepidopteren des palaearctischen Faunengebietes. 3. Aufl. — Friedländer & Sohn, Berlin. XXX+411 p. (Tagfalter p. 1–97).

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